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The effect of early entrepreneurship education: Evidence from a field experiment

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ABSTRACT

The aim of this study is to analyze the effectiveness of *early* entrepreneurship education. To this end, we conduct a randomized field experiment to evaluate a leading entrepreneurship education program that is taught worldwide in the final grade of primary school. We focus on pupils' development of entrepreneurship knowledge and a set of non-cognitive skills relevant for entrepreneurial activity. The results indicate that knowledge is unaffected by the program. However, the program has a robust positive effect on non-cognitive entrepreneurial skills. This is surprising since previous evaluations found zero or negative effects. Because these earlier studies all pertain to entrepreneurship education for adolescents, our result tentatively suggests that non-cognitive entrepreneurial skills are best developed at an early age. As the entrepreneurship program has various features besides its entrepreneurship content, we must leave it to future research to determine which specific element has the greatest impact on the development of non-cognitive entrepreneurial skills.

1. Introduction

Can entrepreneurship be taught? This question has been the subject of discussion for many years (e.g., Lindquist et al., 2014; Colombier and Masclet, 2008). The sharp increase in the number of entrepreneurship education programs suggests that the general consensus is that entrepreneurship can indeed be taught. From a policy perspective this is an appealing thought. The idea that entrepreneurs are not necessarily born but can also be developed creates a window of opportunity for (educational) policies aimed at enhancing entrepreneurship. However, there is little research on the effectiveness of such educational programs.

In this study we evaluate the effectiveness of an early entrepreneurship education program. A theoretical motivation to look at *early* entrepreneurship education is provided by Cunha and Heckman's (2007) general model of the technology of skill formation. This model emphasizes the importance of early investments in both cognitive and non-cognitive skills. It strongly suggests that an investment in skills not only has a direct impact on the current stock of skills but also produces spill-over effects in subsequent periods by boosting current skills and by making investments later in life more productive.[1] Early investments in skills may thus be particularly effective in the long run.

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[1] Estimating the model using the Children of the National Longitudinal Survey of Youth from 1979, Cunha and Heckman (2008) and Cunha et al. (2010) indeed find evidence for these dynamic spill-over effects.

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0014-2921/

Obviously, the (potential) future spill-over benefits of early investments in skills only occur if the early investment has an immediate impact on the stock of skills in the first place. In this paper we therefore evaluate the *direct* (short term) effect of early entrepreneurship education. We report the results from a randomized field experiment using *BizWorld*, one of the leading, internationally renowned entrepreneurship education programs for primary schools.[2] BizWorld aims to teach children aged 11 or 12 the basics of business and entrepreneurship and to promote teamwork and leadership in the classroom through an experiential learning program that takes 5 days (within a time span of 2–4 weeks). Based on the mission of BizWorld and entrepreneurship education policies more generally, we measure the effect of the program on the development of entrepreneurship knowledge, non-cognitive entrepreneurial skills and entrepreneurial intentions. The sample consists of 63 different primary schools (118 classes, 2751 pupils) in the western part of the Netherlands that voluntarily signed up for the BizWorld program in 2010 and/or 2011. We were able to randomly assign these schools and classes to either the treatment or the control group. In both treatment and control a pre-test–post-test design was used, allowing for an (unbiased) difference-in-differences estimate of the net treatment effect.

This paper's contribution is due to three main characteristics of the study. First, to the best of our knowledge, this is the only study to evaluate the effects of entrepreneurship education on children in primary school (ages 11 and 12). Previous studies of the impact of youth entrepreneurship education follow adolescents. Second, unlike previous studies, we study the development of both knowledge and skills. Finally, we are able to estimate the unbiased (short term) effect of early entrepreneurship education on knowledge and skill development by conducting a randomized field experiment.

To evaluate the effect of the BizWorld program we selected nine non-cognitive skills from the literature that are known to be associated with entrepreneurial choice and/or success.[3] The results indicate that the program has a significantly positive effect on these non-cognitive entrepreneurial skills. On average, the skill levels in the treatment group increase to a larger extent than in the control group for all nine skills tested. The results are significant for seven skills. Self-reported scores on (constructs of) *Risk taking propensity*, *Creativity*, *Need for Achievement*, *Self-Efficacy*, *Pro-activity, Persistence* and *Analyzing* all increase significantly more in the treatment group than in the control group. These non-cognitive skills are not only relevant within an entrepreneurial context. There is an emerging body of research that emphasizes the importance of non-cognitive skills in predicting future labor market outcomes (Heckman et al., 2006; Cunha and Heckman, 2008; Heckman et al., 2013). For example, in the Perry Pre-school program it was not an increased IQ but rather the increase in non-cognitive skills that caused the difference in labor market outcomes between the treatment and the control group years later (Heckman, 2006). Moreover, the improvements in labor market outcomes reported by Chetty et al. (2011) as a result of the project STAR were caused by improvements in personality skills and behavior, rather than by increased test scores. Hence, entrepreneurship education could not only be beneficial to enhance successful entrepreneurship, but also to positively affect labor market outcomes in general. We find that the program is less effective in developing entrepreneurship knowledge. That is, there is no significant impact of the program on this outcome. Furthermore, the results indicate that, if anything, the program has a negative effect on the entrepreneurial intentions of children.

We note that the results reported here reflect the total treatment effect. Possibly, these effects of the program are not (entirely) related to the entrepreneurship component of the program. The fact that children work together in a team in a competitive environment is quite different from the regular school setting. We provide some descriptive evidence that part of the treatment effect could be driven by the teamwork component of the program. However, due to the current set-up of our field experiment we are unable to investigate the effects of the different components of the program separately.

The findings presented above, especially on non-cognitive skill development, are quite different from the mixed results found in the impact evaluation studies conducted so far (e.g. Peterman and Kennedy, 2003; Souitaris et al., 2007; Oosterbeek et al., 2010; von Graevenitz et al., 2010). All of these studies measure the effectiveness of entrepreneurship programs aimed at adolescents in secondary or higher education and most of them focus on the impact on entrepreneurial intentions only. Some studies find positive effects on entrepreneurial intentions (Peterman and Kennedy, 2003; Souitaris et al., 2007), while others find no or even a negative effect (Oosterbeek et al., 2010; von Graevenitz et al., 2010). Part of the explanation for the mixed findings might be that the two studies finding a positive effect are based on non-random assignment; self-selection may then lead to an upwardly biased estimate of the program's impact. Only Oosterbeek et al. (2010) measure the impact on the development of entrepreneurial skills, besides intentions. They find insignificant effects for a student mini-company program that is part of the international 'Young Enterprise' program offered by the Junior Achievement Worldwide network.[4]

Compared to the results found by Oosterbeek et al. (2010), our results tentatively suggest that it might be more efficient to invest in the development of entrepreneurial skills of children rather than of adolescents. On top of the large immediate

[2] This paper is part of a larger research project that was carried out within the context of the BizWorld education program (see also Huber et al. (2014)).

[3] An overview of the skills and their association with entrepreneurial choice and performance will be provided in Section 3.3.

[4] Recent studies by Karlan and Valdivia (2011) and Fairlie et al. (2012), using randomized experimental designs, report mixed results on the impact of entrepreneurship training for entrepreneurs. Karlan and Valdivia (2011) find positive effects on business knowledge. However, neither of the studies finds an (positive) impact of entrepreneurship training on business outcomes (also see McKenzie and Woodruff, 2014 for an extensive overview of Business Training and Entrepreneurship evaluations).

(short term) impact that we measure, the empirical literature on the technology of skill formation inspired by Cunha and Heckman (2007) suggests that early investments may also have positive spill-over effects to later periods.[5]

The remainder of this paper is structured as follows. In Section 2 we describe the entrepreneurship education program and its context. The research design is described in Section 3. Section 4 reports the empirical findings. In Section 5 we discuss some potential driving mechanisms underlying our treatment effect and conclude.

2. Program and context

The entrepreneurship education program evaluated in this study is called BizWorld. It is one of the leading entrepreneurship education programs worldwide for primary schools.[6] The program originated in the United States in the late 1990s. Since its inception, over 350,000 children from 84 countries have participated in it.

The program consists of 5 teaching days which can be taught over the course of a 2–4 week period. The lessons, all five with a practical orientation, lead the participating pupils through a firm's business cycle from start-up to liquidation. The first day starts with a theoretical introduction on entrepreneurship. At the start of the practical part on the first day, the teacher divides the class into teams of five or six children. Each child then writes an application letter applying for his/her preferred role within their team. The positions to be fulfilled are General Manager (CEO), Finance Director (CFO), Director of Product Design, Director of Manufacturing, Marketing Director, and Sales Director. The teacher matches the candidates to positions based on their knowledge of the child, the child's application letter and the job descriptions provided in the course guidelines. During the course of the program the team members fulfill their specific roles besides working (and learning) together as a team.

On the second day, each team has to think of a company name, officially register their company with the "Chamber of Commerce", formulate a business plan and present this to a "venture capitalist".[7] Companies sell stocks -where stock prices are determined based on the assessed quality of the business plan- to raise funding to cover the costs of the design and production process. All transactions are made in 'BizEuros' instead of actual Euros.

The third day is devoted to design, procurement and production. The available raw materials for sale (see Fig. 1) are most suitable for producing friendship bracelets, although bookmarks or key or phone cords are alternative possibilities. Production is prepared intensively because production time is limited (to 1 h). After having calculated production costs, including salaries, raw materials and rent, the companies determine the sales price.

The fourth day is used for preparing the marketing campaign, which consists of a poster, the store presentation and a "commercial" (i.e., a 2 min stage play). On this day, the products are also sold to the children in the grade below, usually at an organized fair. Before the sale starts, each team is given the opportunity to present their product by means of their "commercial" in front of the group of prospective buyers. The buyers all have a fixed amount of BizEuro's to spend. After the sales market is over, revenues are calculated. The balance sheet and profit and loss statement are prepared and checked during the fifth and final day of the program. At the end of this day the team that was most successful, in the sense that it has created the highest company value, wins. A small gift for the winning team is usually provided by the entrepreneur or company sponsoring the program. Moreover, the BizWorld foundation provides each member of the winning team with a winning team certificate. In general, children are very motivated to win.

The course materials for the teacher, containing all the details about the education program, are provided by the program. The materials are handed out during a 2 h train-the-trainer session a couple of weeks prior to the program. The guidelines for the program are very strict and described in detail in the instruction manual which is part of the course material. Additionally, instruction videos are available on the BizWorld website, to give the teacher a preview of the course content.[8]

The sample used in this study includes schools in (the western part of) the Netherlands. The Dutch BizWorld program started in 2004 and approximately 30,000 children have since then participated. An addition to the original program from the United States is that the course is taught by an entrepreneur (or someone from the business world) in cooperation with the teacher. The entrepreneur brings real life examples and experiences into the classroom. Furthermore, the Dutch program is externally funded (sponsored by companies and/or subsidized by the government) and is therefore free of charge for the schools.

In The Netherlands, all classes in the last grade of all primary schools – whether private or public – are eligible for BizWorld. Schools usually get in touch with the program through BizWorld marketing campaigns (i.e., BizWorld sending letters to schools to invite them to participate) or through sponsoring entrepreneurs or companies (from the neighborhood for instance). In general the BizWorld Foundation matches schools and sponsoring entrepreneurs willing to participate. Thus, financial or network constraints do not hinder schools' participation in the program.

[5] Our study is not directly comparable to Cunha and Heckman (2008), Cunha et al. (2010) and Heckman et al. (2013). We focus on knowledge and non-cognitive skills specifically related to entrepreneurship (see Oosterbeek et al., 2010) and they focus on a more general set of cognitive and non-cognitive skills (see Section 3.3). Moreover, BizWorld is a much smaller intervention than the Perry Preschool program (Heckman et al., 2013). However, the results we find are consistent.

[6] A similar international program is the 'Young Enterprise' program offered by the Junior Achievement Worldwide network.

[7] Most of the official agencies having a role in the BizWorld program, such as the Chamber of Commerce, bank, venture capitalist, etc. are represented by the teacher.

[8] See: www.bizworld.org/teachers/index.php or www.bizworld-nederland.nl/C100-3-Dag-1-Ontwerpdag.html.

Fig. 1. Course material.

Schools sign up for the program at the beginning of each school year (before January). Most schools have either one or two (parallel) classes in last grade. In general, the voluntary decision to participate is taken at the school level (for all classes in the last grade), although it is possible that one class in a school does participate, whereas the other does not. The minimum level of participation is an entire class, i.e., individual pupils or teams cannot participate.

3. Data and methodology

3.1. Design of the field experiment

To estimate the impact of BizWorld on the development of pupils' knowledge, non-cognitive skills and intentions, a randomized field experiment was conducted between February and July in 2010, and again during the same period in 2011. In January of both years the BizWorld foundation provided us with a list of Dutch schools that planned on participating in the program next spring. In total, 120 schools signed up in 2010 (58 in the western part of the country) and 153 schools in 2011 (55 in the western part). To be able to monitor each school closely, we focus on schools close to Amsterdam. This is where our University is located, in the densely populated western part of the country (where 37% of the population lives).

Due to the endogeneity of the participation choice at the school level, it is not possible to compare schools that chose to participate with schools that did not sign up for the program. Therefore, the schools or classes in the treatment group *and* in the control group were randomly selected from the group of schools that signed up for the program. Thus we assure that all schools in our sample have the same predisposition towards entrepreneurship (education).[9] Random assignment to the treatment or control group takes place at the class level. Hence, for schools with more than one class in the final grade it is possible that one class was assigned to the treatment group and the other class to the control group.[10]

We used a wait-listed control group approach, i.e., classes assigned to the control group were not excluded from participating in the education program. We merely exploited the fact that the period in which the lessons were to be conducted was flexible (i.e., somewhere between March and July). After we had completed the random assignment, the actual dates for the program were determined by mutual agreement between the teacher and the entrepreneur. In the classes in the control group the program was taught a month or two later than in the classes in the treatment group, to make sure that the treatment group has completed the program in the meantime and leaving enough time for the control group to run both the pre and post measurement (see below). The timing of the field experiment is shown in Fig. 2.

To gather the required information for determining the effect of the education program, all pupils had to complete two extensive questionnaires, measuring not only knowledge, skills and intentions but also a wide array of individual background characteristics (see Appendix B). The first questionnaire, accompanied by a letter including some information for the parents about the research project, was sent out to all schools in the sample at the same time (in February of both years).[11] Schools were demanded to have their pupils fill out the questionnaire as soon as possible and we explained to those schools in the control group the purpose and importance of a control group in this type of research.

[9] This means that if there is self-selection with respect to the participation in the program, it is only at the school level. This can, at most, affect the external validity of our results, not the internal validity.

[10] Overall there are eight schools in the sample where, within one year, one of the classes was part of the treatment group and another class was part of the control group.

[11] In the communication towards the parents, the teachers and the entrepreneurs only general information about the research project was given, no details about the evaluation procedure or measures were conveyed.

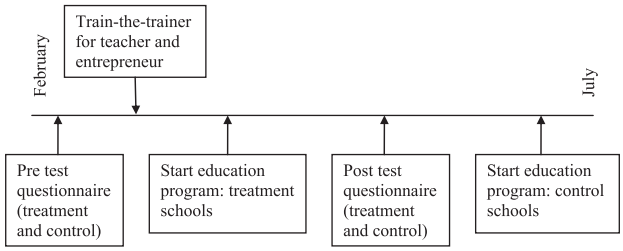

Fig. 2. Time line field experiment.

During the train-the-trainer session for teachers and entrepreneurs prior to the program, the details of the research project were extensively explained and discussed. Moreover, it was emphasized that the teachers and entrepreneurs should not deviate from the course content described in the instruction manual. We visited (the teacher of) every school after they had finished the education program to check their compliance with the course guidelines and to encourage response to the second questionnaire.

The second questionnaire was sent out to both treatment and control schools leaving approximately the same time span between the two questionnaires for both groups. For the control group we emphasized that the questionnaires had to be completed before the start of the education program, i.e., before the first introductory lesson. The pupils of the treatment schools were asked to fill out the second questionnaire after the program. Both questionnaires were carried out under the supervision of the class teacher. The lay-out of the questionnaires was specifically designed in such a way that the responses could be scanned and coded by a specialized computer system. To ensure the objective measurement of all the outcome variables, the responses from the entire survey were evaluated only by the researchers (not by the teacher or the entrepreneur).

This research design has some drawbacks. Most prominently, we cannot measure long term treatment effects due to the fact that all children in our sample eventually participate in the program. However, establishing *direct* short term effects provides a (necessary) first step in the investigation if the model of skill formation (as proposed by Cunha and Heckman (2007)) also holds for the development of non-cognitive entrepreneurial skills and knowledge. Furthermore, the current set-up of our field experiment allows us to estimate the overall treatment effect of participating in this entrepreneurship education program. However, it prevents us from estimating the influence of the different components of the program separately (e.g., learning about entrepreneurship, working in a team or being taught by an entrepreneur).

3.2. Sample

All schools that signed up for BizWorld in the western part of the Netherlands, i.e., 58 and 55 in 2010 and 2011 respectively, were contacted by the beginning of February in the respective years. We informed them about and invited them to participate in the research project. In total, of the 58 (55) schools in our research population 12 (16) schools refused participation in 2010 (2011).[12] Our resulting sample consists of 46+39=85 schools consisting of 64+54=118 classes and 2751 pupils in the last grade (2010+2011).[13] Because the program is executed at the class level, we treat classes as the unit of observation, not schools.[14]

Table 1 shows the sample composition. 77 classes have been randomly assigned to the treatment group and 41 classes to the control group (Column 1).[15] However, some classes had to be switched from the control group to the treatment group or the other way around after the initial assignment (but before the start of the program). Teachers and entrepreneurs often met for the first time at the train-the-trainer session and planned the dates for the program there. Sometimes, their joint calendars did not allow participation in the assigned control group (21 classes) or treatment group (13 classes).[16] The second column of Table 1 shows the realized sizes of the treatment (85 classes) and the control group (33 classes), whereas the right

[12] In 2010 (2011), 3 (4) had objections against the research project and 9 (6) schools eventually decided to drop out of the education program. In 2011 another 6 schools were disqualified from the sample because they had already started the education program before we could send them the first questionnaire.

[13] At the school level there was an overlap between 2010 and 2011 resulting in a sample of 63 different schools.

[14] A robustness check will be shown that confirms the validity of this practice. The validity check will address the possible effects of assuming independence of observations at the class level (i) of multiple class observations within one school in the same year and (ii) within schools that participated twice (2010 and 2011). Appendix Table A1 shows the distribution of schools in the sample with one, two and more classes that participated in one or both years in the program.

[15] The unbalancedness in the treatment assignment is related to treatment variations that we executed within the context of the program and parallel to our impact evaluation study. These other treatments pertain to variations in reward structure and in team composition (see Huber et al., 2014). We performed additional checks (not reported here), in which we included additional dummy variables for each treatment dimension to make sure that these treatments did not interfere with the estimation of the main results in this paper. This check confirmed that there is no systematic correlation between the development of the outcome variables and the other treatments.

[16] For participation in the control group the program should be planned later in the Spring such that the second questionnaire could be filled out before the start of the program. On the contrary, for participation in the treatment group the program should be run sufficiently early in the Spring semester leaving enough time between the end of the program and the summer holidays to complete the second questionnaire.

Table 1
Sample composition.

Sample	Classes		Pupils	
	Initial assignment	Final participation	Full sample	Final sample
Treatment	77	85	2001	1729
Control	41	33	750	684
Total	118	118	2751	2413

hand side of the table (Column 3 and 4) shows the distribution of *pupils* over the treatment and control groups (1729 versus 684 in the final sample). The full sample consists of 2751 pupils who have filled out at least one of the two questionnaires, whereas the final sample only includes those pupils who have filled out both questionnaires ($n=2413$).[17] The overall response rate is 87.7%. Because we are interested in the development of individuals over time, our final sample consists only of the observations of those children for whom we have received both questionnaires.

3.2.1. Internal validity

An important assumption underlying the validity of the (difference-in-difference) estimation is the random assignment to the treatment and control group. In theory, our procedure should have resulted in random assignment of children with different (observed and unobserved) characteristics to the two groups in the sample at $t=0$. However, two changes that occurred between the initial random treatment assignment and the final treatment participation (see Table 1) possibly contaminate the research design: (i) The reshuffling of classes between the treatment and control group after the initial assignment and (ii) possibly selective attrition from the sample between the pre- and post-measurements.

A comparison between the observed characteristics of the individuals in the treatment and control groups in the final sample shows hardly any differences in the pre-treatment outcome variables and background characteristics, see Table 2 Columns 9–11.[18]

To address the potential problem of non-random reshuffling of classes from the treatment to the control group or vice versa after the initial assignment, we will re-estimate the main specification while removing the classes that switched between treatment and control group from the sample. Section 4 will show that the results from this estimation are almost identical to our main results. Furthermore, to alleviate concerns regarding non-random attrition, Table 2 shows that the differences between the treatment and the control group are very similar in the full and the final samples. In addition, separate regressions per outcome variable also show that attrition is random.[19]

Finally, we also checked with the teachers whether the children in the control group were systematically engaged in activities specifically aimed at changing entrepreneurial skills and intentions at the time of our field experiment. We acknowledge that this would be unlikely, especially given the fact that they intend to participate in the treatment program a bit later. Indeed, the check confirms that this is not the case.[20]

We conclude that there are no observed pre-treatment differences between the treatment and control group. Hence, the random assignment was not contaminated by the reshuffling of classes from the treatment to the control group after the initial assignment. Additional checks confirmed that there is no selective attrition. Together, these results show that the estimated treatment effect is indeed causal. Furthermore, we are confident that the measured treatment effects are not biased (downwards) due to the engagement in the same kind of program by classes in the control sample.

3.2.2. External validity

The external validity of this experiment could be limited for two reasons. First, the program might be a-typical in this sample due to the research project. Second, the sample itself might not be representative for the population studied. With respect to the program there is little that can be tested. However, the large number of schools involved in the project and our small influence on the execution practice makes us confident that the program tested is very similar to the general practice in The Netherlands. We acknowledge, though, that the program is slightly different in The Netherlands from elsewhere, for instance in the United States, where the involvement of entrepreneurs is lacking.

[17] In 2010 all classes returned the pre-treatment questionnaires and only one class did not fill out the second questionnaire. In 2011 the first questionnaire was missing for one class, and the second for four classes. Some questionnaires were missing in both years due to the absenteeism of individual children at 'test' days.

[18] The only significant difference is that a larger part of the children attending Roman Catholic schools is part of the treatment group, whereas a larger part of the children attending Protestant schools has been (accidentally) assigned to the control group. The percentage of children attending public schools, however, is the same for both groups. We compared the (observed) individual characteristics of the children going to Roman-Catholic and Protestant schools and we found no significant pre-treatment differences between these two groups.

[19] In these regressions the dependent variable is an indicator for whether or not the outcome variable is observed, and the explanatory variable is the treatment dummy.

[20] There were two exceptions: in 2010 one school participated in a micro-finance program in the month prior to the entrepreneurship education program (i.e., at the time the pre-test was completed). In 2011 another school was part of an entrepreneurial primary school project (not specifically designed for the children in the last grade). Estimating the treatment effect without these schools confirmed that the results remain the same.

Table 2
Pre-treatment differences between the treatment and the control group.

	Total sample	**Full sample**					**Final sample**				
	Treatm. + Contr. (1)	Control (2)	Treatment (3)	diff (T-C) (4)	SE (5)	*p*-value (6)	Control (7)	Treatment (8)	diff (T-C) (9)	SE (10)	*p*-value (11)
Non-cognitive entrepreneurial skills											
Risk taking	4.415	4.386	4.425	0.0387	(0.075)	0.605	4.368	4.417	0.0491	(0.076)	0.522
Creativity	4.361	4.303	4.382	0.0786	(0.079)	0.323	4.293	4.385	0.0919	(0.081)	0.260
Need for achievement	4.542	4.545	4.541	−0.0040	(0.082)	0.962	4.542	4.540	−0.0017	(0.085)	0.984
Self-efficacy	4.157	4.151	4.159	0.0077	(0.064)	0.904	4.137	4.164	0.0272	(0.066)	0.682
Social orientation	5.041	4.994	5.058	0.0644	(0.072)	0.372	4.986	5.063	0.0765	(0.075)	0.309
Pro-activity	4.574	4.558	4.580	0.0212	(0.067)	0.751	4.562	4.572	0.0094	(0.067)	0.889
Persistence	4.899	4.937	4.884	−0.0527	(0.065)	0.423	4.934	4.886	−0.0480	(0.068)	0.484
Analyzing	4.219	4.202	4.225	0.0221	(0.068)	0.747	4.193	4.228	0.0349	(0.073)	0.632
Motivating	4.856	4.846	4.860	0.0139	(0.064)	0.827	4.834	4.863	0.0297	(0.069)	0.666
Intentions and knowledge											
% Entrepreneur intentions	0.249	0.267	0.243	−0.0238	(0.021)	0.260	0.276	0.250	−0.0265	(0.022)	0.238
Own business (0: no, 1: maybe, 2:yes)	1.126	1.098	1.137	0.039	(0.033)	0.237	1.083	1.140	0.056	(0.034)	0.098*
% Entrepreneurship knowledge	0.729	0.729	0.729	−0.0003	(0.019)	0.987	0.755	0.746	−0.0088	(0.017)	0.613
Background (individual)											
% Female	0.503	0.497	0.506	0.0091	(0.020)	0.650	0.499	0.510	0.0113	(0.020)	0.577
Age pre-test	11.625	11.650	11.616	−0.0343	(0.033)	0.305	11.642	11.610	−0.0317	(0.035)	0.371
High school track (1: pre-voc - 5: pre-uni)	2.946	2.930	2.952	0.0219	(0.133)	0.869	2.951	2.952	0.0013	(0.136)	0.993
Nationality parents: Both non-dutch	0.322	0.360	0.308	−0.0522	(0.062)	0.405	0.336	0.280	−0.0563	(0.064)	0.380
% Mother entrepreneur	0.075	0.076	0.074	−0.0015	(0.014)	0.910	0.082	0.076	−0.0061	(0.015)	0.675
% Father entrepreneur	0.152	0.136	0.158	0.0219	(0.021)	0.297	0.146	0.165	0.0186	(0.022)	0.406
Education mother (1: uni - 4: no high school)	2.059	2.015	2.076	0.0605	(0.097)	0.535	2.029	2.074	0.0454	(0.099)	0.649
Education father (1: uni - 4: no high school)	1.923	1.930	1.929	−0.0013	(0.078)	0.987	1.913	1.927	0.0200	(0.082)	0.809
Number of observations	2751	750	2001				684	1729			
Background (school)											
Class size	24.25	23.82	24.41	0.5968	(1.076)	0.581	24.04	24.44	0.403	(1.053)	0.703
Roman Catholic	0.285	0.113	0.350	0.2365	(0.089)	0.01***	0.117	0.359	0.242	(0.091)	0.01***
Protestant	0.366	0.495	0.318	−0.1763	(0.121)	0.150	0.515	0.302	−0.213	(0.120)	0.081*
Public	0.282	0.282	0.281	−0.0013	(0.095)	0.989	0.265	0.290	0.025	(0.095)	0.793
Other religion (Islam, Hindu)	0.056	0.091	0.043	−0.0472	(0.037)	0.201	0.099	0.050	−0.049	(0.040)	0.227
Neighborhood characteristics (based on 4-digit postal code)											
Average income per year in euros	20,148	19,848	20,260	411.97	(943.29)	0.664	19,985	20,212	226.41	(958.34)	0.814
Number of observations	63	26	51				25	48			

Note: */**/*** indicates significance at the 10%/5%/1%-level. Observations on individual characteristics are clustered at the class level. School and neighborhood characteristics are clustered at the school level. Robust standard errors in parentheses.

Concerning the representativeness of the sample (for the Dutch population of school kids in the last grade of primary school) we test whether there are statistical differences between the sample and the population in terms of individual, school and neighborhood characteristics.[21] The information on those characteristics was collected by means of the questionnaires, schools' websites and Statistics Netherlands, respectively.

The pre-treatment individual background characteristics for the entire sample are shown in the first column of Table 2. As expected, girls make up 50% of our sample and the average age is 11.5 years. The distribution of the intended future high school track – its measure based upon the pupils' (self-reported) registration in these tracks for the next school year – is also in accordance with the national distribution.[22] Approximately 8% of the mothers of the children in the sample is an entrepreneur and 16% of the fathers run their own business, which is also in line with the countrywide average of 11% and 18% percent among working mothers and fathers, respectively. The percentage of children in the sample with a Dutch background (i.e., whose parents are both born in the Netherlands) is 56%, and somewhat lower than for the population (79%). The fraction of Surinam, Turkish and Moroccan children in our sample is higher, i.e., 8.8%, 3.5% and 4.1% respectively compared to approximately 2% for each of these in the population. This difference could be caused by the limitation of our population to the large urban areas in the western part of the Netherlands, where the ethnic diversity is largest.

At the school level, the sample seems fairly representative too. The average class size is 24 children (national average is 23.4). The distribution across (religious) denominations of the schools is also representative; 29% of the children in the sample go to Roman-Catholic schools, 37% go to Protestant schools and 28% go to public schools.[23] The school's neighborhood level statistics on income imply that the schools participating in the program are situated in a representative cross section of neighborhoods.[24]

3.3. Outcome variables

Based on the mission of BizWorld and entrepreneurship education policies, we measure the development of the following individual outcome measures: non-cognitive entrepreneurial skills, entrepreneurship knowledge, and intentions to become an entrepreneur.

Non-cognitive entrepreneurial skills

Since the early sixties, entrepreneurship researchers have been interested in which non-cognitive skills are associated with (successful) entrepreneurship (see for instance Begley and Boyd, 1987; Sexton and Bowman, 1985; Hornaday and Aboud, 1971). Following the study by Oosterbeek et al. (2010) we selected nine non-cognitive skills from the literature that are known to be associated with entrepreneurial choice and/or success and that, moreover, can be measured in a valid way in the realm of the current field experiment among pupils of 11 or 12 years old. These relationships are summarized in Table 3.[25]

Ever since Knight (1921) *risk taking propensity* has been defined as one of the distinguishing characteristics of entrepreneurs (see for example Kihlstrom and Laffont, 1979; Kanbur, 1979). Subsequent empirical research has mostly shown that entrepreneurs have a lower degree of risk aversion than others (Stewart and Roth, 2001; Cramer et al., 2002; Hvide and Panos, 2013).[26] As already noted by Schumpeter (1934) entrepreneurs must be able to generate new ideas and form new combinations, i.e. to be successful as an entrepreneur a person must be *creative*. Another characteristic that is traditionally associated with entrepreneurship is *need for achievement* (McClelland, 1965; Shane and Venkataraman, 2000). That is, an entrepreneur sets challenging goals and continuously seeks to improve his or her performance (Begley and Boyd, 1987). Furthermore, Chen et al. (1998) find that *self-efficacy* is positively associated with probability of becoming an entrepreneur, because confidence in one's own ability increases the willingness to pursue entrepreneurial opportunities. Moreover, several empirical studies have shown that *social orientation* is important for becoming an entrepreneur as well as for the success rate of new ventures (e.g. Davidsson and Honig, 2003; Dahl and Sorenson, 2012; Roberts and Sterling, 2012). Social orientation is the ability to benefit from social connections and from interactions with others (Glaeser et al., 2002). The relationship between *pro-activity* and *persistence* and entrepreneurship has also been studied and is found be positive for the start-up of a company and for subsequent venture growth (Baum et al., 2001). *Analyzing* refers to analytical or problem solving skills. It is the ability to create or spot opportunities by systematically analyzing and solving a problem, and is thus a relevant skill for entrepreneurs (Ward, 2004; Baron and Ensley, 2006). Finally, *motivating* skills are associated with new venture growth (Baum and Locke, 2004) as well as better labor market outcomes in general (Borghans et al., 2006). Table 3 provides an overview of the relationships established in the literature between the non-cognitive skills we measure and entrepreneurial choice (Column 3) and success (Column 4).

[21] Each neighborhood is characterized by a four-digit postal code (see www.cbsinuwbuurt.nl.

[22] The high school tracks in the Netherlands range from pre-vocational secondary education (1) over senior general secondary education (3) to pre-university education (5), and with combination tracks in between.

[23] Note that (almost) all primary schools in the Netherlands, irrespective of their denomination, are publicly funded, i.e., there is a 'money follows pupil' system.

[24] The average gross income in these neighborhoods is 20.147 per income recipient per year, whereas the national average is 24.100 for couples with children below the age of 18 and 16.100 for single parents with children below the age of 18.

[25] We note that the empirical evidence on the association between many of these skills and entrepreneurship is not conclusive, thus what we report are commonly found associations (see e.g. Zhao et al., 2010; Parker, 2009 for an overview).

[26] However, the empirical evidence is rather mixed, including contradicting (e.g. Brockhaus, 1980), non-linear (Caliendo et al., 2010) and insignificant results (e.g. Parker, 2008).

Table 3
Non-cognitive entrepreneurial skills and knowledge.

Outcome variables	Definition	Association with entrepreneurial		Cronbach's α
		Choice	*Success*	
Non-cognitive skills				
Risk taking	Predisposition towards risky alternatives	+	∩	0.75
Creativity	Ability to create many opportunities	+	+	0.75
Need for achievement	Desire to do well	+	+	0.69
Self-efficacy	Belief in own ability	+	+	0.67
Social orientation	Ability to make useful connections	+	+	0.63
Pro-activity	Willingness to take action	+	+	0.58
Persistence	Ability to continue despite setbacks	+	+	0.61
Analyzing	Ability to assess complex situations	0	+	0.56
Motivating	Ability to inspire or stimulate subordinates	0	+	0.80
Entrepreneurship knowledge	Knowledge about running a business	+	+	

Note: A '+' indicates that the existing literature has established a positive relationship between the skill and entrepreneurial intentions or success , '0' indicates no association has been established and '∩' refers to an association that follows an inverse U-shape.

The separate skills presented in Table 3 are not solely important for entrepreneurs, but are powerful predictors of social economic success in general (e.g. Heckman et al., 2006, 2013). Moreover, any direct effect could induce future spill-over effects (through dynamic complementarity and self-productivity of skills) and thereby make early investments in non-cognitive skills even more effective in the long run.[27] However, the non-cognitive skills used in our study are not directly comparable to those studied by Cunha and Heckman (2008), Cunha et al. (2010) and Heckman et al. (2013). The non-cognitive skills they study are measured through the Behavior Problem Index in the first two papers, and the Pupil Behavior Inventory (PBI) in the latter. Both tests measure childhood temperament traits and precede the well known (and commonly used) Big Five traits of personality inventory. Certain aspects of the Big Five personality traits, i.e., Conscientiousness, Openness to Experience and Emotional Stability have been positively associated with entrepreneurial choice and success (Zhao et al., 2010). The non-cognitive skills we use are related to these Big Five traits, e.g. *persistence* and *need for achievement* are related to Conscientiousness, and *creativity* and *pro-activity* are related to Openness to Experience (see Almlund et al., 2011, Table 3 for a complete overview of the Big Five traits and their facets). Thus, developing these skills, separately or some combination, is beneficial for both future entrepreneurs and employees.

The non-cognitive skills are measured by means of a validated self-assessment test. Self-reported paper and pencil tests are the most widely used measures in personal psychology (Borghans et al., 2008). Recent psychological studies have confirmed the validity of the use of self-assessment tests in middle and late childhood, i.e., for children between 8 and 12 years old (Barbaranelli et al., 2003; McCrae et al., 2002). The test is based on the one used and further validated by Oosterbeek et al. (2010) and Hoogendoorn et al. (2013). Of course, because our study pertains to children at the age of 11 or 12 instead of (young) adults, we have developed and validated a slightly adapted version of this test. We did so in close collaboration with a child psychologist. Three elements characterize the transformation for the younger target group. First, the questionnaire is shorter than the original, using three instead of four items per skill, thus matching the concentration time span of children.[28] Second, certain constructs, such as market awareness, networking skills, etc., were excluded because they are difficult to relate to as a child. Third, we rephrased the original statements to make them easier for children to understand (see also Barbaranelli et al., 2003). Examples of statements are: "I can encourage other children to do their best" (motivating), "I want to perform better than others" (need for achievement), "I like to take chances" (risk taking), and "I think I'm good at solving problems" (self-efficacy). Statements had to be answered on a seven-point scale, expressing the extent to which a child agrees with each statement (see Appendix B for the entire questionnaire).

We use (standardized) Cronbach's α to measure the internal consistency and validity of our measures.[29] The Cronbach's α's range from 0.56 to 0.80 (see the last column of Table 3).[30] Traditionally in the literature a cut-off of 0.70 is considered

[27] Pfeiffer and Reuss (2008) use a simulation model calibrated to German data to get an idea of the financial returns to investments in skills that the Cunha and Heckman (2007) model may imply. Consistent with the predictions by Knudsen et al. (2006) and Borghans et al. (2008), self-productivity and direct complementarity are assumed to differ between cognitive and non-cognitive skills. In early childhood these are higher for cognitive than for non-cognitive skills, but from late childhood (10 to 11 years old) onwards this is the other way around. As a result, investments in cognitive skills are relatively more important during the pre-school years, whereas the school years play an important role in the development of non-cognitive skills. Because the positive complementarities decrease over time, the analysis of Pfeiffer and Reuss (2008) also suggests that additional investments in pre-school and primary school yield higher returns than investment impulses in secondary or tertiary education.

[28] The overall score for each skill is calculated by the weighted average of the three items. The weighting is determined by the contribution of each item to the construct based on the values calculated by a principal component analysis for each construct.

[29] When starting with the development of the test for children, we tested the (internal) validity of our adapted measures by conducting a pilot study consisting of 118 children who participated in the BizWorld program and filled out both pre-test and post-test questionnaires in the fall of 2009. One skill (*Flexibility*, α=0.10) was removed from the questionnaire and another skill (*Need for power*, α=0.46) was replaced by *Need for achievement*.

[30] The reported Cronbach's α is the unweighted average of the values from the pre- and post-test questionnaire. The average spread between these two measurements is 0.04.

satisfactory. However, alpha is a function of the number of items in a scale (Cortina, 1993). Since we have only three items per scale, we decided to use a slightly less stringent criterion of 0.60 as a cut-off. Because the reliability of α as a measure of internal validity has been subjected to debate (Revelle and Zinbarg, 2009), we also conducted a principal component analysis to check the independence of the scales. This test revealed that *self-efficacy*, *need for achievement* and *pro-activity* do not load into separate factors, despite the high Cronbach's α for the first two constructs.[31]

The outcome variable is defined as the development in each non-cognitive skill (Δy). The development is measured per individual by the change in the score of each construct between $t=0$ and $t=1$ (i.e., $\Delta y_i = y_{i1} - y_{i0}$).

Entrepreneurship knowledge

Evidence on the relationship between entrepreneurship experience and the decision to become an entrepreneur is consistently positive (Parker, 2009). According to Shane (2003) experience includes training for skills such as selling, problem solving, organizing and communicating. These are also the type of skills and knowledge that are taught during the entrepreneurship education program. Therefore, one could expect a positive (mediating) effect of the development of entrepreneurship (related) knowledge on entrepreneurial choice (see last row in Table 3).

The association between knowledge and entrepreneurial success also appears to be positive. In general, human capital theory states that education increases productivity and thus leads to higher income (Mincer, 1958; Becker, 1964). In the entrepreneurship literature the link between education and business performance or entrepreneurial income has also been widely established (Bates, 1990; Robinson and Sexton, 1994; Fairlie and Robb, 2007). Moreover, the meta-analysis conducted by Unger et al. (2011) shows that there is a significant positive relationship between task-related human capital and entrepreneurial success.

One of the desired results of the BizWorld program is the development of knowledge that is relevant for entrepreneurship, i.e., knowledge about what an entrepreneur does and what it entails to run a business. A set of seven specific multiple choice questions is used to measure this knowledge. Examples are: "If a company makes less revenue by selling products or services than it spends, it will … (a) be registered at the stock market, (b) make a profit, (c) make a loss, (d) have debts", and "To set the price of a product you have to take into account … (a) how much it costs to make the product, (b) how many products can be made in a certain amount of time, (c) the price that competitors ask for their products, (d) all of the above". The outcome variable is the development of entrepreneurship knowledge, which is measured by a change, between $t=0$ and $t=1$, in the percentage of correct answers to these questions.[32]

Entrepreneurial intentions

In addition to the main outcome variables, we measure the impact of the program on the children's intentions to become an entrepreneur. Although raising entrepreneurial intentions is not a specific goal of the program, it is one of the main goals of entrepreneurship education in general and it is frequently used as an outcome measure in other impact evaluation studies. However, as mentioned in the introduction, findings on the effect of participation in an entrepreneurship education program on entrepreneurial intentions are mixed (e.g. Oosterbeek et al., 2010; Peterman and Kennedy, 2003).

The measurement of entrepreneurial intentions at the age of 12 is difficult and no precedents are available to indicate the validity or predictive power of any such measure. We use two different measures to estimate the change in the intention to start a business as a result of program participation. First, children were asked to select a maximum of three jobs they might like for their future occupation from a list of 22 professions, one of which was 'entrepreneur – (boss in your own company)'. A dummy variable (Future job: entrepreneur) is created to indicate whether *entrepreneur* was on the list of three. This was the case for a quarter of the sample pre-treatment. The change in intentions is measured by the differences in this (dummy) variable between the first and the second questionnaire.

The second measure of entrepreneurial intentions (Own Business) is the answer to the question: 'Do you think that you would like to start your own company one day?'; (*yes*, *no* or *maybe*). This variable was coded in such a way that a change in the answer to this question from *no* (code 0) to *maybe* (code 1) and from *maybe* to *yes* (code 2) is regarded as a similar increase in entrepreneurial intentions. A change from *no* to *yes* is regarded as a more positive change in intentions. We will interpret the results for intentions with great care for the reasons stated before.

Table 4 reports the descriptive statistics of all the outcome variables for the entire sample and for the treatment and the control group separately.

4. Results

4.1. Estimation method

To analyze the effect of the BizWorld program on the outcome variables, a difference-in-differences analysis (DID) is used. The value of the outcome variable of individual i in the treatment group before the start of the program ($t=0$) is

[31] We will thus apply some caution when interpreting the results for these measures.

[32] To prevent children from memorizing the answers to the knowledge questions, three out of the seven questions in the first questionnaire were rephrased in the second questionnaire (see Appendix B). For example, instead of asking about making a loss (as in the example question given above), the question was: "If a company makes *more* revenue by selling products or services than it spends, it will … (a) be registered at the stock market, (b) make a profit, (c) make a loss, (d) have debts". These changes were determined prior to the start of the education program and applied to the entire sample (i.e., treatment and control group).

Table 4
Descriptive statistics of outcome variables.

Outcome variables ($\Delta\overline{y}=\overline{y}_1-\overline{y}_0$)	Treatment		Control		Treat + Control	
	Mean	**Std. Dev.**	**Mean**	**Std. Dev.**	**Mean**	**Std. Dev.**
Risk taking	0.21	1.15	0.11	1.13	0.180	1.14
Creativity	0.22	1.17	0.15	1.10	0.199	1.15
Need for achievement	0.25	1.07	0.08	1.00	0.197	1.05
Self-efficacy	0.22	1.02	0.08	0.91	0.177	0.99
Social orientation	0.11	1.01	0.07	0.92	0.098	0.99
Pro-activity	0.14	1.02	−0.01	0.94	0.094	1.00
Persistence	0.03	1.07	−0.10	1.02	−0.009	1.05
Analyzing	0.22	1.01	0.11	0.90	0.190	0.98
Motivating	0.13	1.17	0.06	1.15	0.113	1.17
Entrepreneurship knowledge	0.04	0.21	0.02	0.21	0.035	0.21
Future job: entrepreneur (0/1)	−0.003	0.46	0.02	0.46	0.004	0.46
Own business (0–2)	−0.09	0.63	0.07	0.60	−0.047	0.62

denoted by $y_{Ti,0}$, while $y_{Ti,1}$ gives the corresponding value after the treatment period ($t=1$). For the control group, similar notation is used, i.e., $y_{Ci,0}$ and $y_{Ci,1}$. The difference between the two measures, $\Delta y_{Ti}=y_{Ti,1}-y_{Ti,0}$ and $\Delta y_{Ci}=y_{Ci,1}-y_{Ci,0}$, reports the changes in the level of each outcome variable between time $t=0$ and $t=1$ for an individual in the treatment or the control group respectively. The average change per outcome variable between the pre-test and the post-test of all the children in the treatment and the control group are denoted by Δy_T and Δy_C. Hence, the DID estimate is given by

$$\delta=\Delta y_T-\Delta y_C \tag{1}$$

Double differencing removes potential biases associated with the common development of the children over time that are unrelated to the program (Imbens and Wooldridge, 2009).[33] The skills we measure, although related to entrepreneurship, can be developed in several ways. Most importantly, since all the children in the sample are in school during our observation period, some development in these skills is expected even without participation in the program. Additionally, other everyday activities, e.g. at sports clubs or other social events, could also be beneficial for the development of non-cognitive skills. Finally, part of the increase observed, in the treatment as well as the control group, might be due to the Hawthorne effect. However, assuming that any potential Hawthorne effect is equally strong in both groups (i.e., they both fill out the same questionnaires), the use of a difference-in-differences estimator will remove this potential overestimation of the treatment effect.

For each individual ($i=1,\ldots,N$) the following variables are observed: $D_i, y_{i0}, y_{i1}, X_{i0}$, and X_{i1}. Where D_i is a dummy variable which takes the value 1 if individual i was part of the treatment group, y_{it} is the outcome value for individual i at time t, and X_{it} is a vector of control variables for individual i at time t. The difference, $\Delta y_i=y_{i1}-y_{i0}$, is then regressed on the treatment indicator, D_i, and the lagged outcome, y_{i0}:

$$\Delta y_i=\alpha+\delta D_i+\beta y_{i0}+\epsilon_i \tag{2}$$

For the ease of the interpretation and the comparison between the results of the different outcome variables we use standardized outcome and explanatory variables in our main specification. Furthermore, the baseline level of the outcome variable is included to correct for a potential ceiling effect (i.e., if your initial score or skill level is high, there is less room for improvement as a result of the treatment). The observations are clustered per class to obtain estimates with robust standard errors, accounting for the fact that the results for children in the same class are potentially correlated. To confirm the robustness of the estimated coefficients from Eq. (2), we will also estimate the model with a vector of control variables (X_i) such as age, gender, parental entrepreneurial activity, etc.[34]

4.2. Main results

The results for the DID estimation of Eq. (2) are shown in Table 5. The mean values for the outcome variables at $t=0$ and $t=1$ are shown for both the treatment (Columns 1 and 2) and the control group (Columns 4 and 5). Columns 7 and 8 of Table 5 show the net treatment effect, δ, and the robust standard errors in parentheses.

[33] To estimate the treatment effect, the panel structure of the data is used together with the unconfoundedness assumption given the lagged outcomes. The unconfoundedness assumption requires that conditional on a set of observed covariates (i.e., controls and outcomes), treatment assignment is essentially randomized (Imbens and Wooldridge, 2009, p.23). Given the set-up of our experimental design, we feel that it is safe to assume that this assumption holds in our sample.

[34] If the randomization was successful, in principle, a simple level regression should yield the same results as the DID. Estimating Eq. (2) using the level of the outcome variable at $t=1$ (y_{i1}) as the dependent variable (both with and without control variables) indeed gives the same results as the ones presented in the next section. We choose to report the DID estimates as our main specification, because we feel that the development of skills and knowledge is a more interesting outcome variable than the level (of these outcome variables) at a certain point in time.

Table 5
Treatment effects.

Outcome variables	Treatment				Control				**DID (using standardized measures)**			
									No controls		With controls	
	(1) $t=0$	(2) $t=1$	(3) $\Delta y_T = y_{T1} - y_{T0}$		(4) $t=0$	(5) $t=1$	(6) $\Delta y_C = y_{C1} - y_{C0}$		(7) δ		(8) δ	
Non-cognitive entrepreneurial skills												
Risk taking	4.41	4.62	0.208***	(0.024)	4.37	4.48	0.111**	(0.044)	0.100**	(0.044)	0.108**	(0.045)
Creativity	4.38	4.60	0.216***	(0.029)	4.30	4.45	0.155***	(0.043)	0.083*	(0.045)	0.098**	(0.047)
Need for achievement	4.54	4.78	0.245***	(0.026)	4.54	4.62	0.077**	(0.038)	0.158***	(0.049)	0.151***	(0.051)
Self-efficacy	4.16	4.37	0.218***	(0.025)	4.14	4.22	0.075**	(0.035)	0.150***	(0.049)	0.156***	(0.043)
Social orientation	5.06	5.17	0.108***	(0.025)	4.99	5.06	0.073**	(0.035)	0.064	(0.053)	0.049	(0.053)
Pro-activity	4.57	4.70	0.136***	(0.025)	4.57	4.56	−0.009	(0.036)	0.145***	(0.051)	0.166***	(0.045)
Persistence	4.89	4.91	0.026	(0.026)	4.93	4.84	−0.098**	(0.039)	0.100**	(0.047)	0.105**	(0.046)
Analyzing	4.23	4.45	0.223***	(0.025)	4.20	4.30	0.107***	(0.035)	0.130***	(0.044)	0.138***	(0.049)
Motivating	4.87	5.00	0.132***	(0.029)	4.84	4.90	0.065	(0.045)	0.068	(0.047)	0.061	(0.048)
Entrepreneurship knowledge	0.75	0.79	0.040***	(0.006)	0.75	0.77	0.019**	(0.009)	0.071	(0.066)	0.042	(0.063)
Entrepreneurial intentions												
Future job: entrepreneur (0/1)	0.25	0.25	−0.004	(0.011)	0.28	0.30	0.023	(0.018)	−0.090*	(0.050)	−0.075	(0.050)
Own business (0–2)	1.14	1.05	−0.094***	(0.015)	1.08	1.15	0.070***	(0.023)	−0.213***	(0.049)	−0.217***	(0.051)
Number of observations	1729	1729			684	684			2351		2304	

Note: The estimates in each cell come from separate regressions. Observations clustered at the class level, robust standard errors in parentheses. All regressions control for the baseline level of the outcome variable. DID with controls includes individual characteristics: age, gender, future high school track, nationality parents, parents entrepreneurial status; school/neighborhood characteristics: class size, school denomination, avg. income per year and a year dummy for 2010/2011. */**/*** indicates significance at the 10%/5%/1%-level.

Non-cognitive entrepreneurial skills

All but one of the non-cognitive entrepreneurial skills increase significantly between $t=0$ and $t=1$ within the treatment group. The only exception is *Persistence* for which the difference is positive, but not significant. In the control group six of the non-cognitive skills change positively and significantly in the same period. *Motivating* and *Pro-activity* do not show a significant change and *Persistence* decreases significantly for the children in the control group. The fact that the children in the control group also develop their skills in this time frame shows that they do not spend the time that the treated children spend on the program idly. They develop their non-cognitive skills through the regular lessons offered. This emphasizes the importance of a control group in our research design.

The results for the DID analysis show that the difference in development between the treatment and the control group is positive for all non-cognitive skills. The change in these outcome variables is larger in the treatment group than the control group. The treatment effect is statistically significant for seven out of the nine skills: *Risk taking propensity*,*Creativity*, *Need for Achievement*, *Self-efficacy*, *Pro-activity*, *Persistence* and *Analyzing*.[35] The last column (Column 8) of Table 5 shows that the treatment effects remain the same or increase slightly when we control for individual, school and neighborhood characteristics as well as the year of the data collection.[36]

The size of the treatment effects we find is substantial. For instance, children in our treatment group show a significant increase in Creativity of 0.10 of a standard deviation compared to the control group. Self efficacy, Risk taking and Need for Achievement increase by 0.16, 0.11 and 0.15, respectively. Overall, the results show that the effect sizes are between 0.05 and 0.16 of a standard deviation. Moreover, on top of this immediate (short term) impact, early investments may also induce future spill-over effects (through dynamic complementarity and self-productivity of skills) and thereby make early investments in non-cognitive skills even more effective in the long run.

Entrepreneurship knowledge

The estimated effect on entrepreneurship knowledge, can also be found in Table 5.[37] Both within the treatment group as well as in the control group there is a significant increase in the percentage of correct answers between $t=0$ and $t=1$. The increase is slightly larger in the treatment than in the control group, which results in a positive, yet insignificant, estimate of the net treatment effect (δ). The picture remains unchanged when we include the set of control variables. Therefore, the program does not seem to have the intended effect on the development of entrepreneurship knowledge.

Entrepreneurial intentions

The results for the first intention measure, i.e., future job choice, show that the intention towards becoming an entrepreneur decreases slightly within the treatment group and increases slightly within the control group between $t=0$

[35] Note that *Self-efficacy, Need for achievement* and *Pro-activity* did not load into separate factors and therefore require careful interpretation of the results for these measures.

[36] See Table A3 in the Appendix for the detailed estimation results pertaining to the controls.

[37] The detailed estimation results for entrepreneurship knowledge and entrepreneurial intentions are shown in Table A2 in the Appendix.

and $t=1$. This results in a negative and marginally significant estimate of the net treatment effect without controls. The result is insignificant when controlling for individual, school and neighborhood characteristics.

The results from the second measure show that the intention to start a business some time in the future decreases significantly for the children in the treatment group, whereas the children in the control group show a significant positive change in this intention. Therefore, the DID estimate for this intention measure (from both equations) is significantly negative. Thus, in line with the results found by Oosterbeek et al. (2010), we find that, if anything, this entrepreneurship education program has a negative effect on the intention towards becoming an entrepreneur. Alternatively, the program could have an indirect effect on entrepreneurial intentions. The non-cognitive entrepreneurial skills that we measure are (almost) all positively associated with entrepreneurial intentions. Hence, the significantly positive effect of the program on these skills, might (positively) influence the intention to become an entrepreneur in the future. As mentioned before, due to the lack of validated measures of entrepreneurial intentions for children, we treat these results with caution.

4.3. Robustness checks

The results from the previous section show that our findings are robust when we include a variety of individual, school and neighborhood characteristics. We perform several more robustness checks.

First, as announced, we estimate Eq. (2) excluding the classes from the sample that switched between the treatment and the control group after the initial treatment assignment. A priori, the choice to switch was only guided by practical concerns and we expect no relationship with the outcome variables. Indeed, the results from these estimations are the same for most outcome variables, only for Analyzing ($\delta=0.11$, $p-value=0.12$) and Creativity ($\delta=0.07$, p-value$=0.25$) the results are slightly weaker than the main results. This may also be due to the fact that the sample size reduces from 118 to 84 classes when excluding switchers.

Second, in order to test whether the actual treatment status (i.e. the dummy for treatment participation) is in fact exogenous, we compare the estimated coefficients for this variable from the OLS with the coefficients from a 2SLS estimation (using initial treatment assignment as an instrument) using a Wu–Hausman F-test (Hausman, 1978) for endogeneity. For this test the null hypothesis is that the OLS estimate is consistent, i.e. that the treatment status is exogenous. We perform this estimation separately for all outcome variables (F-test range from 0.0004 to 1.29, with p-values of 0.98 and 0.26, respectively). Thus the results from this test confirm that the actual treatment participation is indeed exogenous (i.e. random).

A third robustness check indicates that it is unlikely that the results are influenced by a possible appreciation bias. For example, if the children are very enthusiastic about the program, we might be measuring the children's sheer appreciation of the program instead of actual learning. However, we measure a low positive correlation coefficient between the grade the children assigned to the education program (on a scale of 1–10) to express their appreciation of it, and their skill development, i.e., between 0.05 and 0.13.

Fourth, we rule out that the effects measured are only very short term and temporary. To this end, we measure if the impact of the time elapsed between the program and the completion of the second questionnaire on our outcome variables is negative. Time elapsed is (imperfectly) measured as the number of days between the start of the program and the day we received the second questionnaire (36 days on average, varying from 13 to 70 days, std. dev. 15 days, while the duration of the program itself was approximately two weeks on average).[38] Evidently, this test only includes the treatment and not the control group. The estimation shows that the time elapsed between the education program and the post-test questionnaire does not change our main results.[39] Additionally, we compare the time elapsed between the receipt of the two questionnaires between the treatment and the control group, to ensure that this does not vary systematically by treatment status. The degree of variation in the timing of the responses to the pre and post-test is virtually identical in the two groups. Hence, we are confident that we are indeed measuring the same developmental time trend in both groups.

Fifth, clustering observations at the school ($n=63$) instead of at the class level ($n=118$), we establish that the (significant) results remain significant. Although the children, and in some cases also the teacher, change from one school year to another, one could argue that the observations per school are potentially correlated. The results of these estimations are the same and are shown in Tables A4 and A5 in the Appendix. Moreover, the randomization into treatment and control group was done at the class level. Hence, one could argue that the class, instead of the individual should be the unit of analysis. As a robustness check, we perform the same analyses at the class level and the results are very similar, albeit slightly less significant due to the loss of observations. The results for this analysis are shown in Table A6 in the appendix.

The findings from the checks described above show that our results are stable to various changes applied to the original specification. Therefore, we are confident that the early entrepreneurship education program we study has a robust positive effect on non-cognitive entrepreneurial skills.

[38] Unfortunately this detailed information was only available for the 2011 sample.

[39] We only find a significant negative time effect on the development of Social orientation (p-value: 0.02), which was not significant in our initial estimation.

4.4. Heterogeneous treatment effects

The starting point for our analysis of heterogeneous treatment effects are the control variables that have a significant impact on the outcome variables (see Tables A2 and A3 in the Appendix). For example, the development of entrepreneurship knowledge and some non-cognitive entrepreneurial skills are distinct for males and females. For all independent variables that apparently move the intercept, we test whether they are also associated with heterogeneity in effect sizes. In particular, we considered interactions with gender, age, intended high school track, school denomination, year (2010 versus 2011 or both) and the average income in the school's area. We do not find any heterogeneities for these variables. Additionally, we looked at differences between children with and without parents active as an entrepreneur. In the empirical literature there is some evidence of inter-generational transmission of entrepreneurial skills and occupational choice (Lindquist et al., 2014; Colombier and Masclet, 2008; Dunn and Holtz-Eakin, 2000). However, we do not find any significant differences in the treatment effect on any of the outcome variables for children with entrepreneurial parents. For other variables a few (insignificant) results are noteworthy.

Using the model developed by von Graevenitz et al. (2010), we test whether the change in intention was moderated by a person's entrepreneurial ability.[40] This turned out not to be the case: the change in entrepreneurial intentions due to treatment is the same for children with high and low pre-treatment entrepreneurial ability. We also test the proposition by von Graevenitz et al. (2010) that the decision to become an entrepreneur becomes more defined after the program, i.e., that the variance in the responses (for business ownership intentions) is larger after the program than before. However, the results do not support this proposition either. Thus, we find little evidence of sorting.

Additionally, we considered the possible effect of the size of the team on the change in outcome variables (thus excluding the control group from the sample). Most of the teams consist of five or six children, but team size can vary between four and seven members per team. Despite the greater likelihood of free riding in bigger teams, possibly leading to less active participation, we do not find smaller learning effects for larger teams, nor does team size affect entrepreneurial intentions.

All in all, because we find almost no heterogeneities in treatment effects, we conclude that the effects we establish hold by and large across the board.

5. Discussion and conclusion

5.1. Discussion

Before we reach our conclusion, we provide in this subsection an interpretation of the treatment effect that was established in Section 4. The results show that participation in the BizWorld education program has a robust significant positive effect on the development of non-cognitive skills. However, this entrepreneurship education program simultaneously introduces several learning aspects into the classroom that are different from the regular learning experience. First of all, the program teaches the children about entrepreneurship, which is not part of the regular (primary) school curriculum in the Netherlands. Secondly, the program involves teamwork, which can be a source of inspiration and confidence building and thereby could have a stimulating effect on the non-cognitive skills. Finally, bringing an entrepreneur or someone from the business world into the classroom to teach the course, as is done in the Dutch program, could also trigger the development of certain skills. As such, each of these (major) components could influence the development of entrepreneurial skills in its own way.

To understand which part of the program drives the overall treatment effect established in Section 4, we perform several (albeit imperfect) tests. For these tests we use some qualitative evidence that we collected by means of the second questionnaire, i.e., after the education program.[41] To start with the entrepreneur, we look at two questions: one measures the importance of his or her role, and the other measures the children's appreciation for the entrepreneur. The appreciation is measured by the grade that the children give the entrepreneur on a scale of 1–10. The analysis shows that the grade is positively correlated with the development of all the non-cognitive skills. However, the correlation coefficients are small in size (between 0.05 and 0.10). Furthermore, we measure the importance of the role of the entrepreneur by looking at a question that asks the children to place the components of the program in such an order to indicate what motivates them to do their best from 1 (most important) to 7 (least important). The possible answers are: play a game, being taught by an entrepreneur, work in a team, a change to normal school days, to be able to make money, learn about business and entrepreneurship, and show what I can do. When comparing the answers “being taught by an entrepreneur” is the least important reason (rank 4.72) for the children to perform well. Hence, based on these descriptive results, the presence of the entrepreneur does not seem to have a major impact on the learning process.

The relationship between teamwork and learning is studied in various empirical papers from the economic literature as well as in education research. For instance, the paper by Hamilton et al. (2003), that studies the effect of teamwork

[40] von Graevenitz et al. (2010) develop a formal Bayesian updating model to explain the mixed findings on entrepreneurial intentions and predict that program participation causes a sorting effect among students with different entrepreneurial abilities. Those students who discover to be less suitable for becoming an entrepreneur will have lower intentions after the program than those who receive positive signals during the course. They find empirical support for their sorting prediction.

[41] Hence, the information from these questions is only available for the children in the treatment group.

on productivity, finds that part of the increased productivity can be attributed to mutual learning. Recent work by Hoogendoorn and Van Praag (2012) also indicates that (mutual) learning might be one of the mechanisms that explains why more ethnic diverse teams achieve better results. Research in educational settings shows that students working in small groups learn more efficiently than students solving problems individually, because teams seem to be better at handling problems with complex information (Plass et al., 2013; Kirschner et al., 2011). Moreover, several studies indicate that cooperative learning only leads to better achievements if group rewards are provided (Pai et al., 2014; Lou et al., 1996).

The optimal way to disentangle the teamwork component from the entrepreneurship part of the program would be to compare our findings to those from a very similar early entrepreneurship education program in which the whole program is done by the children individually. However, since (a study about) the counterfactual is not available, i.e., entrepreneurship education on an individual basis rather than in teams, such a specific comparison cannot be made. Therefore, we can only provide some descriptive evidence on the association between teamwork and the changes in our outcome variables. The results from these tests are presented below.

First, several team characteristics, such as the mean and the variance of the initial skills and knowledge (at the team level), are added to the estimation equations. If some of these team characteristics were correlated with the learning outcomes, this would indicate that teamwork or certain team dynamics are beneficial for the skill development. None of these characteristics turn out to be important in the development of individual knowledge or non-cognitive entrepreneurial skills, nor for the changes in entrepreneurial intentions. With this test we estimate the effect of (small) differences in the team composition on the development of the outcome variables. However, since all the children in our sample work together in teams, small changes in group composition might not capture the teamwork component we are looking for.

Secondly, to shed some more light on the teamwork mechanism, we use the answers to the question "Which part of BizWorld did you like best?". The possible answers are: start-up a company, design a product, teamwork, calculations, production, sales, taking decisions, and make financial statement. The children are asked to rank the topics from 1 (like best) to 8 (like least). Seven of the possible answers are related to the business component of the program and one is about working together as a team. 6.8% of the pupils answer that they like teamwork the best, and 40.1% included teamwork in their top three of favorite parts of the program. If we look at the specific element of starting up a company, we find that for 7.1% of the children this is their favorite part and it was ranked among the top three by 35%. We also compare the overall ranking between the teamwork component and the start-up component. This comparison shows that the mean rank for teamwork is 4.01 and the start-up component has an average rank of 4.24. Both rankings are not far from the mean and the difference is small, yet significant.

Finally, we also have information on how well the team worked together. However, this measure is less precise and, as can be expected, the results show that the conditional correlation between the ex-post evaluation of how well the team worked together and the outcome variables is mostly positive.

The descriptive tests presented above show that the significant overall treatment effect we find could be the result of different elements of the program. The current set-up of the field experiment does not allow us to study the different elements separately. Future research with different treatment variations, e.g. in the team component and the entrepreneurial tasks in the program, are necessary to be able to disentangle the different effects.

5.2. Conclusion

Given the key role entrepreneurial activity has in fostering economic growth and innovation, the evaluation of measures that may stimulate successful entrepreneurship is of high interest to both academics and practitioners alike. Since entrepreneurship education programs are used worldwide, we thus believe that testing their effectiveness is an important first step. The evaluation studies that have been performed so far have only found modest effects at most as well as contradictory results. This seems to suggest that these programs are ineffective as a policy tool to promote entrepreneurial knowledge, skills or intentions.

However, until now the focus has been on entrepreneurship programs targeted at adolescents in secondary or higher education. The insignificant effects found there may well be due to the fact that entrepreneurial skills and knowledge are more easily developed earlier in life or because the returns to training programs later in life depend on investments in knowledge and skills made earlier. In fact, the model of skill formation introduced by Cunha and Heckman (2007) emphasizes such dynamic spill-over effects. In this model cognitive and non-cognitive skills are developed during different stages in life, where the skills learned during one period in life (e.g. at primary school) augment the benefits of investments in these skills in subsequent periods (e.g. at high school or university). Early investments in skills may thus be particularly effective in the long run.

In view of the potential importance of *early* educational investments, we evaluate the immediate (short term) effect of entrepreneurship education on the development of entrepreneurship knowledge and non-cognitive entrepreneurial skills of children aged 11 or 12. We also consider the program's impact on entrepreneurial intentions. By using a randomized field experiment we are able to obtain unbiased estimates. Our main finding indicates that the program has the intended effect; pupils in the treatment group show a significant increase in their non-cognitive entrepreneurial skills compared to those in the control group. Entrepreneurship knowledge is unaffected by the program though. The negative effects on

entrepreneurial intentions must be taken with a pinch of salt, because measuring entrepreneurial intentions of children at the age of 11 or 12 is difficult. However, as pointed out by von Graevenitz et al. (2010), an overall decline in entrepreneurial intentions might actually be the preferred response to the program. If the program provides the children with a more realistic view of what it entails to be an entrepreneur, this could cause a positive sorting effect in that only those pupils with high entrepreneurial ability will choose an entrepreneurial career.

The program evaluated in this study takes 5 days and has a significant and quite substantial positive effect on the development of non-cognitive entrepreneurial skills. Remarkably, the program aimed at college students evaluated by Oosterbeek et al. (2010) is more involved in both time and costs and has no discernible effect on entrepreneurial skill development. Moreover, as mentioned above, the skills formation literature inspired by Cunha and Heckman (2007) strongly suggests that there are important dynamic spill-over effects in the development of skills over time. It may therefore be likely that the effects of entrepreneurship programs in tertiary education will become larger among people who participated in these programs at a younger age. Additionally, the early development of non-cognitive skills may have a wider impact because they are known to have a positive effect on labor market outcomes in general. It thus appears that non-cognitive entrepreneurial skills are best developed already at an early age.

The positive results are novel and remarkable, even though they reflect only effects in the short run from one specific entrepreneurship education program. Obviously, our design does not allow the measurement of longer term effects of early entrepreneurship education because all children eventually participated in the program (justified on ethical grounds). Nevertheless, finding short term effects is a first step towards a better understanding of the effects of entrepreneurship education and the validity of dynamic spillover effects in the realm of entrepreneurship education.

A word of caution is required with respect to the exact mechanism that drives our results. The qualitative evidence discussed in Section 5.1. show that teamwork, in addition to (or instead of) the entrepreneurship element of the program, might be an important factor in the development of the non-cognitive skills. The current set-up of our field experiment unfortunately prevents us from disentangling the effect of these two mechanisms. Hence, we must leave it to future research to determine which of these elements has the greatest impact on the development of non-cognitive entrepreneurial skills. Another important drawback of our research design is that we do not measure the opportunity cost of the program. Even though the program only lasts 5 days, it would be interesting to know if, and to what extent, participation crowds out the learning of other types of knowledge and skills.

Few studies have so far employed methods that allow a similar causal interpretation. We only evaluate one specific early entrepreneurship program and Oosterbeek et al. (2010) evaluate only one specific program aimed at college students. It may well be the case that results for other programs are different (although both of these programs are the largest in their league worldwide). Hence, the results only suggest that early entrepreneurship education is more effective than later entrepreneurship education. The significant immediate (short term) impact on non-cognitive entrepreneurial skills for children established in this paper may be encouraging for (entrepreneurship) education policy. Our result also provides a relevant first step for future research to investigate whether the model of skill formation indeed holds for the development of entrepreneurial skills as well.

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Appendix A

Table A1-A6.

Table A1
Composition of classes within the schools across years.

# schools	1 year	2 years
1 class	29	10
2 classes	9	11
>2 classes	2	2

Table A2
Treatment effects entrepreneurship knowledge and intentions (detailed).

Δ	*Entrepreneurial intentions*		Entrepreneurship knowledge
	Future job: entrepreneur	Own business	
Treatment effect (δ)	−0.08 (0.05)	−0.22 (0.05)	0.04 (0.06)
Background (**individual**)			
Female	−0.18 (0.04)	−0.12 (0.04)	0.11 (0.04)
Age ($t=0$)	−0.02 (0.02)	−0.02 (0.02)	−0.02 (0.02)
Parents both not dutch	−0.07 (0.04)	−0.03 (0.05)	−0.15 (0.05)
Mother entrepreneur	0.11 (0.07)	0.16 (0.06)	0.06 (0.06)
Father entrepreneur	0.16 (0.05)	0.25 (0.05)	−0.05 (0.05)
Intention level at $t=0$	−1.27 (0.04)	−0.54 (0.02)	
Knowledge level at $t=0$			−0.79 (0.03)
High school:			
Pre-University	0.20 (0.06)	0.09 (0.05)	0.76 (0.06)
Pre-Uni and senior general	0.11 (0.06)	0.13 (0.05)	0.66 (0.06)
Senior general secondary	0.11 (0.06)	0.003 (0.07)	0.42 (0.07)
Pre-vocational and senior general	0.09 (0.06)	0.10 (0.05)	0.36 (0.07)
(*omitted category: Pre-vocational*)			
Background (**school**)			
Class size	−0.005 (0.02)	0.03 (0.03)	0.03 (0.03)
Avg. income per year (x1000, − Euros)	−0.02 (0.02)	0.02 (0.02)	0.008 (0.02)
Protestant	−0.02 (0.05)	−0.04 (0.05)	0.09 (0.08)
Roman Catholic	−0.08 (0.05)	−0.04 (0.05)	0.07 (0.08)
Religion other	0.18 (0.10)	0.07 (0.10)	0.03 (0.13)
Year dummy (1=2010/0=2011)	0.02 (0.04)	−0.03 (0.04)	−0.03 (0.05)
constant	0.36 (0.06)	0.15 (0.07)	−0.40 (0.09)
Number of observations	2360	2354	2141

Robust standard errors in parentheses. Observations clustered at the class level.

Table A3
Treatment effects non-cognitive entrepreneurial skills (detailed).

Δ	Motivating	Analyzing	Pro-activity	Creativity	Self-efficacy	Need for achievement	Risk taking	Social orientation	Persistence
Treatment effect (δ)	0.06 (0.05)	0.14 (0.05)	0.17 (0.05)	0.10 (0.05)	0.16 (0.04)	0.15 (0.05)	0.11 (0.04)	0.05 (0.05)	0.10 (0.05)
Background (**individual**)									
Female	0.06 (0.04)	−0.08 (0.03)	0.004 (0.04)	−0.06 (0.04)	−0.07 (0.04)	−0.09 (0.04)	−0.11 (0.03)	0.11 (0.04)	0.07 (0.03)
Age ($t=0$)	0.02 (0.02)	0.02 (0.02)	0.008 (0.02)	0.01 (0.02)	0.02 (0.02)	−0.01 (0.02)	−0.003 (0.02)	−0.01 (0.02)	0.03 (0.02)
Parents both not dutch	0.05 (0.05)	0.02 (0.06)	−0.02 (0.05)	−0.004 (0.05)	0.05 (0.05)	0.04 (0.05)	−0.05 (0.05)	−0.05 (0.06)	0.05 (0.05)
Mother entrepreneur	−0.07 (0.09)	0.02 (0.07)	0.08 (0.06)	0.10 (0.07)	−0.05 (0.07)	0.04 (0.06)	0.05 (0.07)	0.03 (0.07)	−0.03 (0.07)
Father entrepreneur	0.009 (0.06)	0.02 (0.05)	0.04 (0.04)	0.03 (0.05)	−0.009 (0.05)	0.13 (0.05)	0.02 (0.05)	0.008 (0.05)	−0.03 (0.04)
Skill level at $t=0$	−0.47 (0.02)	−0.51 (0.02)	−0.46 (0.02)	−0.47 (0.02)	−0.46 (0.02)	−0.46 (0.02)	−0.44 (0.02)	−0.46 (0.02)	−0.46 (0.02)
High school:									
Pre-University	0.22 (0.06)	0.48 (0.07)	0.33 (0.06)	0.33 (0.06)	0.28 (0.06)	0.26 (0.06)	0.04 (0.06)	0.09 (0.05)	0.27 (0.06)
Pre-Uni and senior general	0.22 (0.06)	0.36 (0.06)	0.21 (0.06)	0.30 (0.06)	0.15 (0.06)	0.25 (0.06)	0.14 (0.06)	0.13 (0.06)	0.22 (0.06)
Senior general secondary	0.20 (0.06)	0.13 (0.07)	0.19 (0.07)	0.20 (0.07)	0.15 (0.07)	0.12 (0.06)	0.02 (0.06)	0.10 (0.06)	0.10 (0.07)
Pre-vocational and senior general (*omitted category: Pre-vocational*)	0.22 (0.06)	0.04 (0.07)	0.04 (0.07)	0.08 (0.07)	0.05 (0.07)	0.08 (0.06)	0.11 (0.06)	0.01 (0.06)	0.17 (0.06)
Background (school)									
Class size	−0.007 (0.02)	0.02 (0.02)	−0.03 (0.02)	−0.01 (0.02)	−0.04 (0.03)	−0.004 (0.03)	−0.02 (0.02)	0.002 (0.03)	0.008 (0.03)
Avg. income per year ($\times 1000$, −Euros)	0.02 (0.02)	−0.003 (0.02)	0.01 (0.02)	−0.02 (0.02)	0.01 (0.02)	0.01 (0.03)	0.02 (0.01)	0.03 (0.03)	0.02 (0.02)
Protestant	0.02 (0.05)	−0.02 (0.05)	0.08 (0.05)	0.004 (0.05)	−0.04 (0.05)	−0.03 (0.05)	−0.04 (0.05)	−0.06 (0.06)	−0.06(0.05)
Roman Catholic	0.09 (0.05)	−0.02 (0.05)	0.03 (0.05)	−0.008 (0.06)	0.01 (0.06)	0.02 (0.06)	−0.03 (0.04)	0.005 (0.06)	−0.07 (0.05)
Religion other	0.17 (0.07)	0.07 (0.13)	0.25 (0.10)	0.11 (0.10)	0.27 (0.08)	0.04 (0.08)	0.12 (0.08)	−0.07 (0.10)	0.08 (0.08)
Year dummy (1=2010/0=2011)	0.0004 (0.05)	−0.002 (0.05)	0.04 (0.04)	−0.01 (0.04)	0.08 (0.05)	−0.02 (0.05)	0.0006 (0.04)	−0.03 (0.05)	0.006 (0.04)
constant	−0.28 (0.07)	−0.26 (0.08)	−0.35 (0.08)	−0.23 (0.06)	−0.25 (0.08)	−0.22 (0.07)	−0.06 (0.06)	−0.10 (0.08)	−0.23 (0.07)
Number of observations	2302	2304	2303	2297	2304	2304	2304	2304	2304

Robust standard errors in parentheses. Observations clustered at the class level.

Table A4
Treatment effects non-cognitive entrepreneurial skills (clustered at school level).

Δ	Motivating	Analyzing	Pro-activity	Creativity	Self-efficacy	Need for achievement	Risk taking	Social orientation	Persistence
Treatment effect (δ)	0.07 (0.05)	0.14 (0.05)	0.17 (0.05)	0.11 (0.05)	0.16 (0.04)	0.16 (0.06)	0.12 (0.05)	0.05 (0.05)	0.11 (0.05)
Background (individual)									
Female	0.07 (0.04)	−0.08 (0.03)	0.004 (0.03)	−0.06 (0.04)	−0.07 (0.04)	−0.10 (0.05)	−0.12 (0.04)	0.11 (0.04)	0.08 (0.04)
Age ($t=0$)	0.03 (0.03)	0.03 (0.04)	0.01 (0.03)	0.02 (0.04)	0.02 (0.04)	−0.02 (0.03)	−0.005 (0.03)	−0.02 (0.03)	0.06 (0.03)
Parents both not dutch	0.05 (0.06)	0.02 (0.05)	−0.02 (0.05)	−0.005 (0.07)	0.05 (0.05)	0.04 (0.06)	−0.06 (0.05)	−0.05 (0.05)	0.06 (0.05)
Mother entrepreneur	−0.08 (0.11)	0.02 (0.06)	0.08 (0.06)	0.11 (0.07)	−0.05 (0.07)	0.05 (0.07)	0.05 (0.07)	0.03 (0.07)	−0.03 (0.07)
Father entrepreneur	0.01 (0.06)	0.02 (0.05)	0.04 (0.05)	0.03 (0.05)	−0.009 (0.04)	0.14 (0.04)	0.02 (0.06)	0.008 (0.05)	−0.03 (0.04)
Competency at $t=0$	−0.45 (0.02)	−0.45 (0.02)	−0.43 (0.02)	−0.42 (0.02)	−0.43 (0.02)	−0.37 (0.02)	−0.38 (0.02)	−0.41 (0.02)	−0.43 (0.02)
High school:									
Pre-University	0.26 (0.08)	0.47 (0.07)	0.33 (0.06)	0.39 (0.06)	0.28 (0.06)	0.27 (0.06)	0.05 (0.07)	0.09 (0.06)	0.29 (0.06)
Pre-Uni and senior general	0.26 (0.07)	0.35 (0.06)	0.21 (0.06)	0.34 (0.07)	0.15 (0.06)	0.26 (0.06)	0.16 (0.07)	0.13 (0.05)	0.24 (0.06)
Senior general secondary	0.23 (0.08)	0.13 (0.07)	0.19 (0.06)	0.23 (0.08)	0.15 (0.08)	0.13 (0.06)	0.02 (0.06)	0.10 (0.05)	0.10 (0.06)
Pre-vocational and senior general	0.25 (0.07)	0.04 (0.08)	0.04 (0.07)	0.10 (0.09)	0.05 (0.06)	0.08 (0.07)	0.12 (0.07)	0.01 (0.06)	0.18 (0.07)
Background (school)									
Class size	−0.002 (0.01)	0.004 (0.01)	−0.007 (0.00)	−0.003 (0.01)	−0.01 (0.01)	−0.0008 (0.01)	−0.005 (0.01)	0.0005 (0.01)	0.002 (0.01)
Avg. income per year ($\times 1000$, − Euros)	0.006 (0.01)	−0.0008 (0.00)	0.003 (0.00)	−0.005 (0.01)	0.003 (0.01)	0.003 (0.01)	0.005 (0.00)	0.006 (0.01)	0.006 (0.01)
Protestant	0.03 (0.06)	−0.02 (0.05)	0.08 (0.05)	0.005 (0.05)	−0.04 (0.06)	−0.03 (0.06)	−0.04 (0.05)	−0.06 (0.05)	−0.07 (0.05)
Roman Catholic	0.10 (0.06)	−0.02 (0.05)	0.03 (0.05)	−0.009 (0.06)	0.01 (0.06)	0.02 (0.07)	−0.03 (0.05)	0.005 (0.06)	−0.08 (0.05)
Religion other	0.20 (0.07)	0.07 (0.06)	0.25 (0.05)	0.12 (0.07)	0.27 (0.05)	0.05 (0.08)	0.14 (0.08)	−0.07 (0.07)	0.08 (0.05)
Year dummy (1=2010/0=2011)	0.0005 (0.05)	−0.002 (0.04)	0.04 (0.04)	−0.01 (0.05)	0.08 (0.04)	−0.02 (0.05)	0.0007 (0.04)	−0.03 (0.05)	0.006 (0.05)
constant	1.56(0.42)	1.38 (0.46)	1.66 (0.45)	1.72 (0.48)	1.60 (0.49)	1.85 (0.44)	1.85 (0.42)	2.19 (0.41)	1.02 (0.42)
Number of observations	2302	2304	2303	2297	2304	2304	2304	2304	2304

Robust standard errors in parentheses. Observations clustered at the school level.

Table A5
Treatment effects entrepreneurship knowledge and intentions (clustered at school level).

Δ	*Entrepreneurial intentions*		Entrepreneurship knowledge
	Future job: entrepreneur	Own business	
Treatment effect (δ)	−0.03 (0.02)	−0.14 (0.03)	0.01 (0.01)
Background (individual)			
Female	−0.08 (0.02)	−0.08 (0.02)	0.02 (0.01)
Age ($t=0$)	−0.02 (0.01)	−0.02 (0.02)	−0.006 (0.01)
Parents both not dutch	−0.03 (0.01)	−0.02 (0.03)	−0.03 (0.01)
Mother entrepreneur	0.05 (0.04)	0.10 (0.04)	0.01 (0.01)
Father entrepreneur	0.08 (0.02)	0.16 (0.03)	−0.01 (0.01)
Intention level at $t=0$	−0.58 (0.02)	−0.56 (0.02)	
Knowledge level at $t=0$			−0.72 (0.03)
High school:			
Pre-University	0.09 (0.03)	0.06 (0.04)	0.16 (0.01)
Pre-Uni and senior general	0.05 (0.03)	0.08 (0.04)	0.14 (0.01)
Senior general secondary	0.05 (0.03)	0.002 (0.04)	0.09 (0.01)
Pre-vocational and senior general	0.04 (0.03)	0.06 (0.03)	0.09 (0.02)
Background (school)			
Class size	−0.0006 (0.00)	0.004 (0.00)	0.001 (0.00)
Avg. income per year (× 1000, − Euros)	−0.002 (0.00)	0.003 (0.00)	0.001 (0.00)
Protestant	−0.007 (0.02)	−0.03 (0.03)	0.02 (0.02)
Roman Catholic	−0.03 (0.02)	−0.03 (0.03)	0.01 (0.02)
Religion other	0.08 (0.04)	0.05 (0.05)	0.01 (0.02)
Year dummy (1=2010/0=2011)	0.01 (0.02)	−0.02 (0.03)	−0.006 (0.01)
constant	0.43 (0.17)	0.74 (0.25)	0.50 (0.11)
Number of observations	2360	2354	2190

Robust standard errors in parentheses. Observations clustered at the school level.

Table A6
Treatment effects using standardized measures (class level analysis).

Outcome variables	**DID no controls δ**		**DID with controls δ**	
Non-cognitive entrepreneurial skills				
Risk taking	0.064	(0.05)	0.073	(0.05)
Creativity	0.046	(0.05)	0.046	(0.05)
Need for achievement	0.144***	(0.05)	0.130**	(0.05)
Self-efficacy	0.117**	(0.05)	0.126**	(0.05)
Social orientation	0.036	(0.06)	0.001	(0.06)
Pro-activity	0.123**	(0.05)	0.170***	(0.05)
Persistence	0.082*	(0.05)	0.090*	(0.05)
Analyzing	0.125**	(0.05)	0.135**	(0.06)
Motivating	0.034	(0.05)	0.026	(0.05)
Entrepreneurship knowledge	0.073	(0.07)	0.058	(0.08)
Entrepreneurial intentions				
Future job: entrepreneur (0/1)	−0.081	(0.05)	−0.058	(0.05)
Own Business (0–2)	−0.247***	(0.05)	−0.252***	(0.06)
Number of observations	104		104	

Note: The estimates in each cell come from separate regressions, robust standard errors are in parentheses. All regressions control for the baseline level of the outcome variable. DID with controls includes individual characteristics: age, gender, future high school track, nationality parents, parents entrepreneurial status; school/neighborhood characteristics: class size, school denomination, avg. income per year and a year dummy for 2010/2011. */**/*** indicates significance at the 10%/5%/1%-level.

Appendix B. Supplementary data

Supplementary data associated with this article can be found in the online version at http://dx.doi.org/10.1016/j.euroecorev.2014.09.002.

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