The impact of entrepreneurship education on entrepreneurship skills and motivation ☆

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ABSTRACT

This paper analyzes the impact of a leading entrepreneurship education program on college students' entrepreneurship skills and motivation using an instrumental variables approach in a difference-in-differences framework. We exploit that the program was offered to students at one location of a school but not at another location of the same school. Location choice (and thereby treatment) is instrumented by the relative distance of locations to parents' place of residence. The results show that the program does not have the intended effects: the effect on students' self-assessed entrepreneurial skills is insignificant and the effect on the intention to become an entrepreneur is even negative.

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1. Introduction

Policy makers in Europe and the United States believe that more entrepreneurship is required to reach higher levels of economic growth and innovation. Indeed, empirical research supports positive links between entrepreneurial activity and economic outcomes such as economic growth and innovation (Van Praag and Versloot, 2007). One of the most famous and accepted theories of economic growth underlying these empirical results supporting the economic importance of entrepreneurship has already been provided by Schumpeter (1911). Entrepreneurs seek profit opportunities and therefore introduce 'new combinations' or innovations (Van Praag, 1999) These new combinations are the prime endogenous cause of development in the economic system. New entrepreneurial combinations destroy the equilibrium in the economy and create a new equilibrium (creative destruction). Many endogenous growth theories that have been developed more recently are based on the Schumpeterian model of growth through creative destruction (e.g., Aghion and Howitt, 1998) and thus assign a central role to entrepreneurship for growth.

Policy makers also believe that increased levels of entrepreneurship can be reached through education (European Commission, 2006) and especially entrepreneurship education. Therefore, such education is promoted and implemented into school curricula in many of the European member countries (European Commission, 2006) and the United States (Kuratko, 2005). A key assumption underlying these programs is that entrepreneurship skills can be taught and are not fixed personal characteristics. Indeed, it has been shown that (i) the effect of general education as measured in years of schooling on entrepreneur performance is positive (Van der Sluis et al., 2006; Van der Sluis and Van Praag, 2007), and (ii) business training is effective for the performance of people who applied for microfinance to start their own business (Karlan and Valdivia, 2006).

The dominant entrepreneurship education program in secondary schools and colleges in the US and Europe is the Junior Achievement Young Enterprise student mini-company (SMC) program. In Europe, it is effective in 40 countries and more than 2 million students have participated in the year 2005/2006. The growth rate of the number of students per annum amounted to 25% in the year 2005/2006 (Junior Achievement Young Enterprise Europe annual report, 2006).[1] In contrast to most other interventions in which entrepreneurship training is provided, this program works with a general population of students and not with a group of individuals who self-selected into entrepreneurship.

The SMC program involves taking responsibility as a group, for a small sized and short-time business, from its setting up (usually at the beginning of the school year) to its liquidation (usually at the end of the school year). Students sell stock, elect officers, produce and market products or services; keep records and conduct shareholders' meetings. Thus, students get into contact with social and economic reality in the real business world out of the school. This is a structured project which takes 5–10 h per week and is managed by a team of lecturers. Lecturers are supported by staff of the local non-profit organization "Young Enterprise". The activity takes place in class within the established curriculum, but may also be continued outside the school as a voluntary activity for the students. Each mini-company is supported by one or two advisers coming from the business world and sharing their experience with the students (EU, 2006).

The objective of the program is to teach students to put theory into practice and to understand what entrepreneurship is about. In this way students are assumed to gain self-confidence and motivation, become proactive, creative and learn how to work in a team (Junior Achievement Young Enterprise annual report, 2006). Despite the fact that many schools use the program, little is known about its impact on students' entrepreneurial competencies and intentions. Until now the program's successfulness has only been assessed through the appreciation of the parties involved. No solid impact evaluation study has been conducted so far (EU, 2006). The current study starts to fill this gap by evaluating the impact of a student mini-company program in a vocational college in the Netherlands in the academic year 2005/2006. To do so, we exploit the fact that this college supplies basically the same Bachelor program at two different locations, with one location offering the SMC program and the other not offering it.

Because we measure relevant outcome variables before the start of the program and after the end of it, we can apply a difference-in-differences framework. This produces unbiased estimates of the program's impact if the unobserved characteristics of students in the treated location are not systematically different from students in the untreated location in so far as these would affect the program's results and if there are no other differences between the locations that have an impact on the outcomes related to entrepreneurship. This condition may not hold if students who are more interested in becoming an entrepreneur are more likely to choose the location that offers the SMC program (and learn more or gain more enthusiasm as a consequence). To address this concern we apply an instrumental variables approach, where we use relative distance of the locations to the students' living place before enrolling in post-secondary education as instrument.

The main finding of this paper is that the SMC program does not have the intended effects: the effect on students' self-assessed entrepreneurial skills is insignificant and the effect on the intention to become an entrepreneur is even significantly negative.

The remainder of this paper is organized as follows. Section 2 discusses the particular program and its context. Section 3 describes the empirical approach and its identifying assumptions. Section 4 provides details about the data. Section 5 presents and discusses the empirical results. In Section 6 we summarize and conclude, and offer possible explanations for the surprising findings.

2. Program and context

In the Netherlands, higher education is provided by 52 vocational colleges and 13 universities. Both types of post-secondary education offer study programs at the Bachelor level, whereas universities offer Master courses in addition.[2] The total number of students enrolled in vocational colleges was 357,000 in the school year 2005/2006 (205,000 in universities). Of these, 115,000 were enrolled in study programs in administration, management, economics and law (CBS,

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[1] The idea to set up student companies was born in the twenties in the United States. Supported by, among others, Henry Ford, John Rockefeller and Walt Disney, the association 'Junior Achievement' was founded. The first student company was started up in New York. The program was exported to Europe in the sixties and was named Junior Achievement Young Enterprise.

[2] Usually, the vocational college Bachelor degree, which can be completed in three years, renders a ticket to a Master degree program of two years at the university. For comparison, after completion of a university Bachelor program this same Master degree can be obtained through a one year program. Colleges of vocational education provide more practically oriented programs and the Bachelor degree it leads to is not comparable to a university Bachelor degree.
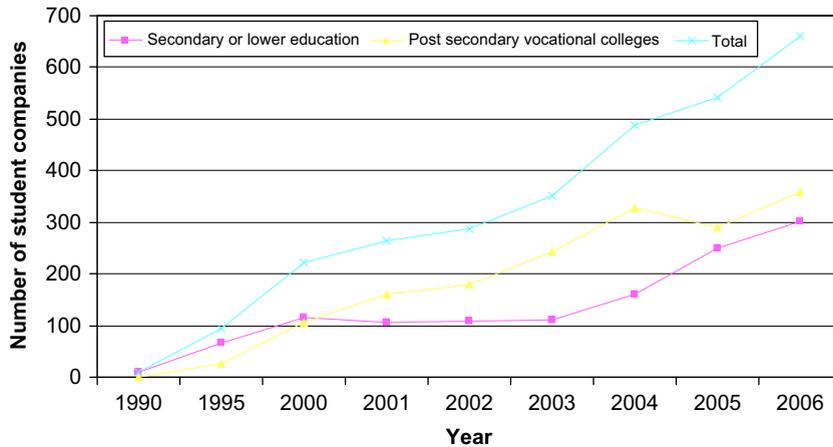
Fig. 1. Number of student mini-companies in the Netherlands per education type.

2007) where the penetration of entrepreneurship education is highest. The SMC program is the leading entrepreneurship education program in post-secondary education in the Netherlands. Most of the student companies are set up in vocational colleges (see Fig. 1), usually in the second year of the study programs in administration, management, economics and law. In the year of our study, almost 360 student mini-companies were founded in colleges, involving 3600 students out of approximately 25,000 students. Participated in the SMC program that has been growing in the Netherlands (see Fig. 1).

SMC programs in the Netherlands are coordinated by the Association *Jong Ondernemen*, founded in 1990 as a non-profit organization and part of the worldwide organization Junior Achievement. The SMC programs offered are conform international standards with the features described in the Introduction. With respect to timing and student work load, in most cases, the program is run for an entire academic year on a part-time basis such that students earn 10 ECTS (out of 60 per annum) by completing the program successfully. Student company management teams consist of 10 students on average. In most of the schools and faculties that offer the SMC program, student participation in the program is mandatory.

Our study has taken place at the vocational college "AVANS Hogeschool", which has three locations in the southern part of the Netherlands, in the cities Breda, Den Bosch, and Tilburg. The number of students enrolled in 2005/2006 was approximately 18,000. Hence, it is a large school with a national market share of five percent. The AVANS Hogeschool with its multiple locations is the result of a merger.[3] Before 2004, the Breda and Den Bosch locations had different names, though they were already managed by a single board. Actually, both locations offer many very similar study programs that have been aligned by the single board in the past years.

For four study programs in the area of administration, management, economics and law, there is actually only one important difference between the two locations: the inclusion of the SMC program. Breda has offered this on a mandatory basis in four of their study programs on a large scale already for a long time, whereas the – otherwise similar – four study programs in the Den Bosch location will only start implementing the SMC program in their curriculum in 2007/2008.[4]

3. Empirical strategy

For the evaluation of the SMC program we use an instrumental variables approach in a difference-in-differences framework (see, for instance, Leuven et al., 2007). Denote by $y_{D=1,\ t=1}$ the mean value of an outcome variable after the year in which the program ran ($t=1$) for those who participated in the program ($D=1$), and by $y_{D=1,\ t=0}$ the mean value of an outcome variable before the start of the program ($t=0$) for the same group ($D=1$). The difference ($y_{D=1,\ t=1}-y_{D=1,\ t=0}$) is then the simple before–after estimator of the effect of the program. This estimator is, however, confounded to the extent that it also captures the effect of other changes between $t=0$ and $t=1$ on the outcome of the program. To correct for that, we contrast this difference with the difference between the outcome before and after the program year of a suitable control group. As control group we use students in the location that does not offer the program ($D=0$). We denote the second difference by ($y_{D=0,\ t=1}-y_{D=0,\ t=0}$), so that our difference-in-differences estimator equals:

$$\delta = (y_{D=1,t=1} - y_{D=1,t=0}) - (y_{D=0,t=1} - y_{D=0,t=0}).$$

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[3] Many Dutch schools of vocational higher education were forced to merge in the past decade to establish larger scale operations.
[4] These programs are: business studies and accountancy, management and law, personnel studies, and small business and retail management.

In practice we estimate δ using regression analysis in which we regress individual changes in outcomes on the dummy variable for program participation. The regression equation is

$$\Delta y_i = \alpha + \delta D_i + \varepsilon_i \tag{1}$$

where Δy_i is the change in outcome for individual i, D_i is a dummy variable equal to 1 if respondent i attended the location that offered the SMC program and 0 otherwise and ε_i is an error term. We will also present estimates of Eq. (1) including a set of student background characteristics (X), such as gender and age.

For all the results we report heteroskedasticity robust standard errors. Because we only have data from two locations, we cannot cluster standard errors at this level. According to Donald and Lang (2007) standard errors cannot be calculated in this two-by-two case and we should therefore be cautious in drawing conclusions. Wooldridge (2006) argues, however, that this criticism is "indistinguishable from a common question raised in any difference-in-differences analysis: How can we be sure that any observed differences in means is due entirely to the policy change?" He argues that if the randomization is done appropriately unobserved cluster effects should be part of the effect to be estimated. In our study the assignment of students to locations is as good as random (see below).

Students' location choices are potentially endogenous; those who are more interested in becoming an entrepreneur, may have chosen the location that offers the SMC program. The difference-in-differences framework addresses this problem to the extent that differences between the groups of students shows up in the baseline levels of entrepreneurial competencies and intentions. It does not, however, accommodate differences in changes in these outcome variables due to unobserved differences between the students of both locations. Therefore, this might invalidate the parallel trend assumption; the before–after-after difference for the untreated students measures what would have been the before–after-after difference for the treated students in the absence of the SMC program. To address the concern that this assumption is not valid for instance because students who have the largest changes in the outcome variables anyhow attend the location that offers this program, we apply an instrumental variables approach. As instrument for location choice we use the relative distance of the locations to the students' living place before enrolling in post-secondary education Z (mostly their parents' place of residence). The identifying assumption is then that (conditional on covariates) this relative distance is unrelated to the error term in the change in outcome equation: $E(Z_i \cdot \varepsilon_i | X_i) = 0$.

The parallel trend assumption also implies that in the absence of the program treated students would have been exposed to the same alternative treatment as the untreated students. However, it is unlikely (and would be undesirable) that untreated students spent the time idly that the treatment group spent on the program. Instead, they may have attended courses that contributed to their entrepreneurial competencies and intentions. To assess this, the AppendixA provides more details about the curricula in the second year in the treatment and controls locations per program. Comparison of these programs shows that courses that were taught in the control programs are not particularly directed to the development of entrepreneurial competencies or to the motivation to become an entrepreneur. Based on the parallel trend assumption we assume that treated students would have done the same if the program was not offered to them. Thus, we estimate the net effect of the SMC program, that is: the effect over and above what is accomplished by programs that are locally designed and organized by the schools themselves and that are not particularly directed towards developing entrepreneurship.[5]

The main limitation of our research design is that we only compare students from two different locations of the same school. Our findings are therefore only informative about the successfulness of the SMC program at that school. Whether the same program is more or less successful when implemented elsewhere remains an open question. It should be noted, however, that *a priori* we had no reason to suspect that the program as run at the "AVANS Hogeschool" would do worse than the average school running this program. It was suggested to us by representatives of the Association *Jong Ondernemen* to approach this particular school. This association has certainly no interest in evaluating the program at a school that performs poorly. If anything we were afraid that they would have suggested us to approach a school that would perform above average. Therefore, we checked the performance of this school relative to comparable vocational colleges and found that the rank of AVANS is indeed above average (but not top).[6]

Notice further that even if the AVANS Hogeschool performs poorer on the program than the average school that already implemented the program, we may still expect that schools that will adopt the program lateron will on average perform worse than the AVANS Hogeschool. This holds if the order in which schools adopt the program corresponds with their expected benefits such that schools that expect to benefit the most adopt the program earlier.

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[5] Given the local design of non-SMC curricula, it is doubtful whether a local alternative curriculum in the treatment location would have been exactly the same. We know, however, that when the control location implements the SMC curriculum, it will be similar to the curriculum in the treatment location. Our impact estimates can therefore be interpreted as the average treatment effect on the untreated.

[6] The Dutch association of vocational colleges (HBO-raad) actually measures the relative performance of vocational colleges regularly, along a couple of dimensions, such as drop-out rates in the first year of the program or the percentage of students who succeed in completing the program within five years (http://www.hbo-raad.nl/hbo-raad/feiten-en-cijfers/). AVANS scores are above average. Moreover a Dutch weekly magazine (Elsevier) performs regular measurements of students' appreciations of their vocational college program along a number of dimensions per study program. Avans school scores on these appreciations for the relevant study programs are higher than average. Please note that these evaluations pertain to the school (or, at best, the study program) in general and not to the specific SMC program that we evaluate. Moreover, the benchmark set of schools includes all vocational colleges (or, at best, those offering the same study programs), not only those that have implemented the program. Unfortunately, no information is known about the relative performance of the SMC program in this school relative to others.

Table 1
Entrepreneur traits and skills.

	Number of items	Cronbach's α	Correlation with entrepreneurial intentions	
			At baseline	At follow-up
	(1)	(2)	(3)	(4)
Traits				
Need for achievement	10	0.79	0.2718***	0.2277***
Need for autonomy	9	0.72	0.1465**	0.2098***
Need for power	8	0.72	0.1577**	0.2002***
Social orientation	8	0.75	0.1868***	0.0581
Self efficacy	9	0.75	0.1909***	0.2750***
Endurance	11	0.80	0.2629***	0.1720***
Risk taking propensity	6	0.69	0.0233	−0.0368
Skills				
Market awareness	10	0.85	0.2561***	0.2749***
Creativity	11	0.84	0.3778***	0.4066***
Flexibility	7	0.69	0.1756***	0.1721***

Note: Columns (1) and (2) based on Driessen and Zwart's (1999) Table 3. **/*** indicates significance at the 5%/1%-level.

4. Data

This section starts with describing in some detail how entrepreneurial competencies and intentions have been measured. After that it describes how the data were collected and presents descriptive statistics.

4.1. Measurement of entrepreneurial compentencies and intentions

Based on many studies of the determinants of successful entrepreneurship, primarily from psychology and business studies, the so-called Escan has been developed (see Driessen and Zwart, 1999; Driessen, 2005). The Escan is a validated self-assessment test based on 114 items (questions and statements) posed to individuals. This is the test we have used to measure students' entrepreneurial competencies. The Escan is widely used in the Netherlands to determine people's entrepreneurial competencies. It is sold through internet to individuals and is used by various companies and institutes, such as the Dutch Chambers of Commerce. For instance, it is a regular test used by a major bank (the Rabo bank) in their assessment of loan granting to starting entrepreneurs. Moreover, it is a standard part of the Dutch SMC program: students use their assessed strengths and weaknesses to determine which competencies should be further developed during the program. The test results have been shown to correlate significantly with objective measures of entrepreneurial performance in terms of survival, profits, income and sales (see Driessen and Zwart, 1999).

The majority (89) of the 114 items are statements and respondents answer on a seven-point scale to what extent they agree with the statement.[7] The statements load into ten factors (with Cronbach alpha's ranging from 0.69 to 0.85) that the entrepreneurship literature has shown to be the most important determinants of successful entrepreneurship, see Table 1.

The first competency is *need for achievement*. Successful entrepreneurs score high on need for achievement by striving for performance adequately and competing, if necessary. They build their company with their professional goals in mind. They set high target levels and put in much effort to reach them. *Need for autonomy* is often the (sub)conscious reason for choosing entrepreneurship. Successful entrepreneurs score high on this competency that reflects independent decision making, the ability to resolve their problems and to bring activities to a successful end on their own. The *need for power* is the need to have control over others to influence their behavior. Successful entrepreneurs score high on this competency indicating that they know what they want and how to influence others to achieve their own goals. *Social orientation* reflects the understanding (of successful entrepreneurs) that connections with others are required to realize their ideas. They make these connections easily and are driven by professional considerations in their social activities. They set their social needs aside and focus on their business. *Self efficacy* reflects the belief in one's own ability, i.e., self-confidence. Successful entrepreneurs are usually convinced that they can bring every activity to a successful end. Also, they feel that they can control their own success, which does not depend on others. Successful entrepreneurs have a high degree of *endurance*. It involves the ability to continue willfully, in spite of setbacks or objections. *Risk taking propensity* in the Escan reflects both the ability to deal with uncertainty and the willingness of risking to take a loss. These are important competencies for successful entrepreneurs.

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[7] Examples of statements are: "I adapt my plans upon changes in circumstances", "I am extremely orientated towards performance", "I prefer other people to take decisions for me", "When I start something new, I know I will succeed", "I have much self-confidence" and "I always persevere until I have reached my target".

Market awareness is the ability to sympathize with the needs of (potential) clients and to link these to one's own business. Successful entrepreneurs appeal to the specific needs of a clearly defined target group of customers and have the ability to anticipate changes in the market based on their awareness of the needs and wants of customers and the (planned) activities of competitors. *Creativity* is the ability to adopt views from different perspectives and to see and try new possibilities based on open observations of (changes in) the environment. Moreover, creativity reflects the capability to turn problems into new opportunities. It is an important ingredient for successful entrepreneurship. *Flexibility*, finally, is based on a measure of the ability to adapt. Successful entrepreneurs react to changes they observe in their environment, such as new needs of clients or new competitors in their market.

A distinction is made between seven traits and three skills, see Table 1. In general, traits do not change over time and are therefore assumed not to be affected by program participation. However, in this particular case trait scores may change during the course of a year since the sample consists of young adults and trait scores become stabilized – on average – when people are 30 years old and they develop considerably during young adulthood, i.e., the college period (Roberts et al., 2001; Robins et al., 2001).[8] Moreover, since the the Escan is a test based on the subject's self-assessment, some of the measured traits may also be affected by developments in personality such as self-confidence. It may even be the case that the SMC program affects the development of trait scores in a different manner than the program followed by the control group, since (work) experience for young people co-determines this development (Roberts et al., 2003).

Skills can in general be learned and improved by program participation (Driessen, 2005) and are thus likely to change in the observed period. Student scores on each of the ten factors are administered on a scale from 1 to 10. We have also aggregated these scores into average scores for 'entrepreneur traits' and 'entrepreneur skills'. The first is the average of the first seven scores, the latter the average of the last three scores.

A short questionnaire was added to the original Escan items to obtain information on students' backgrounds and the self-perceived likelihood of becoming an entrepreneur within the next fifteen years (based on the statement "I expect to start up a new firm or to take over an existing firm within the next fifteen years" and answers on a seven-point scale ranging from "completely agree" to "completely disagree"). The latter is used as a measure of entrepreneurial intentions. The last two columns in Table 1 report the pairwise correlations between each of the entrepreneurial competencies measured by the Escan and the response to the question about entrepreneurial intentions. Column (3) does this for the values measured at baseline ($t=0$), column (4) is based on the values measured in the follow-up survey ($t=1$). With one (baseline) or two (follow-up) exceptions, all these correlations are significantly positive. This reinforces the claim that the competencies measured are associated with entrepreneurship (though not necessarily with successful entrepreneurship).

Besides measuring students' entrepreneurial intentions, the survey served to obtain background information about the students in terms of their gender, nationality, age, secondary education, parental education levels and parental entrepreneurial activity. Moreover, we gathered the students' postal codes just prior to starting their post-secondary education through the survey. Based on these, we calculate the distance to both the treatment and the control location and use the difference between the two as instrumental variable for actual location choice.

4.2. Sample

The survey and Escan were offered prior to the start of the program in September 2005 to a total number of 562 students in four study programs at the treatment (Breda) and control (Den Bosch) locations. The lecturers collaborated in obtaining responses by emphasizing the importance of filling out the questionnaires to their students. Moreover, the management of the school and the regional coordinator of the Association Jong Ondernemen (the latter only for the treatment population) were involved in organizing sessions were students could take the computer test at their school in our presence. The survey and Escan were emailed to students who did not attend these sessions for whatever reason. Tests were not anonymous such that we could merge the results of this pre-measurement with the post-measurement scores on an individual basis. Of the 219 students in the treatment group and the 343 students in the control group, 189 (86%) and 220 (64%) valid[9] surveys were administered at the beginning of the academic year. For students in the treatment group, filling out the Escan is a regular part of the program.

In the period July–September 2006, the 409 students in the sample were requested to fill out the survey and Escan again.[10] This time we experienced difficulties in reaching the students because the end of the program was followed immediately by a prolonged period of summer vacation. We used the help of lecturers, sent emails to the students and placed follow-up phone calls, when necessary. We thus managed to obtain 104 valid post-measurement observations in the treatment group and 146 in the control group. The net response rates over two waves are remarkably similar for treatment and control locations; 47% versus 43%.

All analyses are based on these 250 observations. Unfortunately, there is no way in which we can ascertain that the initial non-response is random. However, we analyze the non-response or attrition bias at the post-measurement phase, see below.

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[8] The personality changes observed from adolescence to adulthood reflect growth in the direction of greater maturity; many adolescents became more controlled and socially more confident and less angry and alienated between the age of 18 and 26. (Roberts et al., 2001).

[9] Sixteen surveys were invalid due to missing values or repeatedly filling out identical answers (for at least 20 consecutive items).

[10] The items pertaining to time invariant background characteristics were omitted.

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

	Final sample		Full pre-attrition sample	
	Treated	Control	Treated	Control
Outcome variables (1–10)				
Entrepreneur traits	6.03	6.06	6.13	6.06
Need for achievement	7.29	7.18	7.33	7.19
Need for autonomy	5.64	5.91	5.69	5.81
Need for power	5.95	6.14	6.03	6.16
Social orientation	6.38	6.13	6.58	6.31
Self efficacy	5.29	5.41	5.54	5.35
Endurance	6.41	6.37	6.44	6.38
Risk-taking propensity	5.25	5.31	5.27	5.28
Entrepreneur skills	5.91	6.01	6.00	6.04
Market awareness	6.16	6.44	6.29	6.43
Creativity	6.08	6.29	6.23	6.34
Flexibility	5.50	5.31	5.47	5.34
Entrepreneur intentions (0–6)	3.52	3.12	3.55	3.31
Student background characteristics				
% Female students	0.45	0.45	0.38	0.42
% Studs (partly) non Dutch	0.04	0.04	0.05	0.05
Age				
% Under 19	0.28	0.20	0.30	0.21
% 19 years old	0.28	0.27	0.26	0.26
% 20 years old	0.24	0.19	0.24	0.19
% 21 years old	0.13	0.19	0.11	0.19
% Over 21	0.07	0.15	0.09	0.15
Secondary school level				
% Vocational (<4 years)	0.24	0.32	0.23	0.28
% General (5 years)	0.63	0.53	0.63	0.59
% General (6 years)	0.11	0.13	0.12	0.11
% Other	0.02	0.02	0.02	0.02
Father's education level (1–5)	3.04	2.91	3.05	2.92
Mother's education level (1–5)	2.69	2.47	2.59	2.50
% Parent ever entrepreneur	0.34	0.33	0.39	0.33
Program				
Business studies and accountancy	0.33	0.26	0.36	0.25
Management and law	0.33	0.42	0.39	0.47
Personnel studies	0.14	0.11	0.10	0.10
Small business and retail	0.20	0.21	0.15	0.18
Number of observations	104	146	189	220

The first two columns report mean values for the sample that is used in the analysis at baseline. The last two columns show the same statistics for the entire, including that are absent post-treatment due to attrition. If both numbers are underlined they are significantly different at the 5% level.

4.3. Pre-treatment differences between treatment and control groups

The validity of the difference-in-differences approach hinges on the comparability of the treatment and control groups. It is therefore important to examine differences between these groups in terms of pre-treatment variables.

The first two columns of Table 2 show to what extent the pre-treatment outcomes and background variables differ between the treatment and the control group. The treatment and control groups are not significantly different from each other before the program started for most of the variables. Exceptions are the score on the skill 'market awareness' which is higher in the control than in the treatment group, the age distribution in the sense that there is a significantly higher percentage of students older than 21 in the control group, and finally, the percentage of students in the program business studies and accountancy.[11] Differences between the treatment and the control group thus appear to be negligible. Nevertheless, we do not exclude the possibility that the treatment and control groups differ in terms of unobservables that might affect the measured outcomes. Therefore, we shall instrument the observed location choice.

4.4. Attrition bias

The last two columns of Table 2 show to what extent the pre-treatment outcomes and background variables differ between the treatment and the control group at $t=0$ if all available observations are included, also the ones for which no post-measurement values are available due to attrition.

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[11] The latter difference is explained by the fact that some faculties were more successful in addressing students to fill out the end-of-term test and survey.

A comparison of the first and the second sets of two columns shows that attrition is unlikely to bias the results. All differences between the treatment and the control group in the used sample are very similar for the extended sample as shown in the last two columns. There are three differences between the treatment and the control group that are slightly different across the used and the extended sample. First, for market awareness, the difference between the treatment and the control group is insignificant in the extended sample whereas it is significant in the used sample. Nevertheless, the differences are almost equal and qualitatively the same. The second difference pertains to the age distribution. In both samples, the percentage of students younger than 19 is higher in the treatment group than in the control group. The difference is significant in the extended but not in the used sample. However, the percentages are very similar (28% versus 20% in the used sample and 30% versus 21% in the extended sample). The same holds for the older age brackets. The differences are similar but they are significant in one sample and not in the other. The third difference relates to the distribution of students over faculties. Again, the differences (in the differences) between the two samples are negligible. This is also confirmed by regressions of a non-response indicator on all available pre-treatment variables. For both locations, the p-value of the F-test of the overall significance of this regression exceeds 0.05.

5. Results

5.1. First stage results

For our estimation of treatment effects we use relative distance of the locations to the students' living place before enrolling in post-secondary education as an instrumental variable for observed location. Breda and Den Bosch are two of the main cities in the Dutch province of Noord-Brabant. The distance between the two cities is around 40 km, with Breda being located more to the west.

One requirement for a variable to be a suitable instrument is that it has a significant impact on the endogenous variable. Table 3 shows the results from first-stage regressions. The specification in the first column includes no other covariates, whereas the specification in the second column includes controls for background characteristics and dummy variables for study programs. In both specifications relative distance is highly significant as indicated by the F-values for the test that this variable could be deleted. The point estimate and its standard error hardly change when controls are included. None of

Table 3
First stage regressions.

	(1)	(2)
Relative distance (in km)	−0.0118*** (0.0004)	−0.0115*** (0.0005)
Control variables	No	Yes
F-value for instrument	771.05***	583.72***
N	250	250

Note: Dependent variable is location choice (1=Breda/treatment; 0=Den Bosch/control). Robust standard errors in parentheses. *** indicates significance at the 1%-level.

Table 4
Effect of distance (instrument) on baseline values of outcome variables.

	(1)	(2)
Traits	0.000 (0.001)	−0.000 (0.001)
Need for achievement	−0.000 (0.002)	−0.000 (0.002)
Need for autonomy	0.002 (0.002)	0.002 (0.002)
Need for power	0.005 (0.003)	0.005 (0.004)
Social orientation	−0.004 (0.004)	−0.005 (0.004)
Self efficacy	0.000 (0.002)	0.000 (0.002)
Endurance	−0.001 (0.002)	−0.002 (0.002)
Risk taking propensity	0.001 (0.002)	0.001 (0.001)
Skills	0.002 (0.002)	0.003 (0.002)
Market awareness	0.005 (0.002)**	0.006 (0.002)***
Creativity	0.003 (0.003)	0.003 (0.003)
Flexibility	−0.001 (0.002)	−0.001 (0.002)
Entrepreneur intentions	−0.003 (0.004)	−0.004 (0.003)
Controls	No	Yes

Note: **/*** indicates significance at the 5%/1%-level. Number of observations equals 250.

the coefficients of the covariates included in the second specification is significantly different from zero. This establishes that relative distance is the key determinant of location choice and thus of assignment to treatment or control group.

For an instrument to be valid, it should have no direct impact on the outcomes of interest. This identifying assumption cannot be tested. We can, however, regress baseline values of the various outcomes on the instrument. Table 4 reports the results, in column (1) for a specification without controls and in column (2) for a specification with controls. Only for one of the 13 (aggregated) outcome variables we find a significant positive coefficient for the instrument; this is for market awareness, with the positive sign suggesting that students living closer to the control location have higher levels of market awareness (as was also shown in Table 2). The impact is, however, small in absolute size. The maximum difference in distance is 40 km, so that the maximum difference in market awareness related to differences in distance equals 0.24. Recall that the outcome variables are measured on a scale from 1–10.

5.2. Treatment effects

Table 5 shows the main results of this paper. Column (1) gives the mean values of the outcome variables for the treatment group at baseline, and column (2) their outcomes after the intervention. Column (3) contains the difference between these two columns, along with its standard error. Columns (4)–(6) give the same information for the students in the control group. Column (6) shows that the scores on entrepreneurial traits increased among students in the control group. Such increases are consistent with the development of traits during young adulthood (Roberts et al., 2001; Robins et al., 2001). The scores did not change significantly among students in the treatment group. Apparently, the experiences in the treatment program give less room to developing traits (Roberts et al., 2003), although the difference of the traits development in the treatment group is only significantly lower than in the control group for 'endurance'.

The differences of the differences are reported in column (7). These estimates are obtained by estimating Eq. (1) without covariates. The estimates in column (8) come from a regression including covariates. Columns (9) and (10) show the estimation results when using the IV-approach.

Hausman tests for the endogeneity of treatment reveals that treatment is only endogenous in the case of the composite variable "Entrepreneurial skills".[12] Apparently, students with the ability and willingness to develop these skills are more likely to be found in the control than the treatment location. For efficiency reasons we base our inferences on the results in columns (7) and (8), except for "Entrepreneurial skills", for which the IV-estimates are preferred.

According to the preferred estimates, the SMC program has a significantly negative impact on entrepreneurial intentions and a zero impact on entrepreneurial skills (and traits). The result is very surprising given the program's objective to develop entrepreneurial skills and affect entrepreneurial intentions of the students exposed to it positively. Although we find a consistent pattern with all point estimates either negative or having a small positive value, positive impacts of around 10% of a standard deviation fall within the 95% confidence interval. This is due to the relatively large standard errors on the estimates.

The finding that entrepreneurial skills do not increase more for treated than for untreated students is indicative of an ineffective program, at least as it is executed at the school of our analysis and relative to the programs that are offered in the control location. However, the finding that the average effect of the program on students' intentions to become entrepreneurs is negative does not necessarily indicate that the program is ineffective. In interviews with lecturers and business coaches involved in the program, it was suggested that the SMC program makes students' expectations about entrepreneurship more realistic. Even with a negative average effect of the SMC program on entrepreneurial intentions, the benefit of the program could be that students with low levels of entrepreneurial competencies become less enthusiastic about entrepreneurship, whereas students with high levels of entrepreneurial competencies become more enthusiastic. We tested for such heterogeneous treatment effects on entrepreneurial intentions by including interactions between the treatment indicator and students' levels of entrepreneurial competencies before the start of the program. This reveals that the effect of treatment is not distinct for students who are potentially successful entrepreneurs and students with less entrepreneurial potential. Hence, the negative effect of the SMC program on entrepreneurial intentions cannot be assessed as beneficial.

We also examined whether treatment effects are different for men and women.[13] By and large the results for men and women are very similar. The main difference is found for the program's impact on entrepreneurial intentions. For women the point estimate is around –0.90 (and significant at the 1% level), while for men the point estimate is around −0.40 (and significantly different from zero only at the 10% level). Hence, both men and women have lower entrepreneurial intentions after being exposed to the program, but the negative impact is more prominent for women, who may have experienced that running an own business is hard to combine with other time uses.

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[12] This result is based on Hausman tests for which the predicted probability of treatment is added to the OLS regressions. A significant coefficient on this variable indicates that treatment is endogenous.

[13] Results are available upon request. For editor/referees: see the attached tables A5M and A5W. These are not intended for publication.

Table 5
Treatment effects

Outcome variables (1–10)	Treatment			Control			DD no controls	DD with controls	DD-IV no controls	DD-IV with controls
	1 $t=0$	2 $t=1$	3(=2-1) Diff	4 $t=0$	5 $t=1$	6(=5-4) Diff	7(=3-6)	8	9	10
Entrepreneur traits	6.03	6.04	0.017 (.060)	6.06	6.20	0.142 (.043)***	−0.125 (.074)*	−0.115 (.077)	−0.092 (.096)	−0.077 (.096)
Need for achievement	7.29	7.30	0.012 (.087)	7.18	7.34	0.158 (.061)***	−0.146 (.106)	−0.150 (.108)	−0.074 (.126)	−0.078 (.127)
Need for autonomy	5.64	5.98	0.341 (.115)***	5.91	6.01	0.102 (.095)	0.239 (.149)	0.204 (.149)	0.173 (.197)	0.188 (.197)
Need for power	5.95	5.67	−0.276 (.161)	6.14	6.19	0.048 (.133)	−0.324 (.209)	−0.299 (.205)	−0.097 (.262)	−0.079 (.259)
Social orientation	6.38	6.38	0.002 (.132)	6.13	6.27	0.138 (.104)	−0.136 (.168)	−0.154 (.178)	−0.171 (.223)	−0.158 (.226)
Self efficacy	5.29	5.46	0.170 (.129)	5.41	5.76	0.355 (.095)***	−0.185 (.160)	−0.124 (.163)	−0.213 (.202)	−0.112 (.207)
Endurance	6.41	6.40	−0.005 (.095)	6.37	6.64	0.276 (.063)***	−0.281 (.114)**	−0.292 (.121)**	−0.239 (.144)*	−0.255 (.151)
Risk-taking propensity	5.25	5.12	−0.126 (.098)	5.31	5.22	−0.083 (.073)	−0.043 (.122)	0.009 (.123)	−0.026 (.157)	−0.040 (.155)
Entrepreneur skills	5.91	5.80	−0.112 (.067)*	6.01	6.09	0.077 (.056)	−0.188 (.088)**	−0.151 (.092)*	−0.057 (.114)	−0.007 (.115)
Market awareness	6.16	6.12	−0.034 (.098)	6.44	6.46	0.017 (.088)	−0.051 (.132)	−0.008 (.137)	0.117 (.167)	0.161 (.171)
Creativity	6.08	5.80	−0.280 (.129)**	6.29	6.37	0.080 (.096)	−0.360 (.161)**	−0.326 (.158)**	−0.263 (.196)	−0.162 (.200)
Flexibility	5.50	5.48	−0.021 (.091)	5.31	5.44	0.133 (.069)*	−0.154 (.114)	−0.120(.118)	−0.026 (.158)	−0.021 (.158)
Entrepreneur intentions(0–6)	3.52	3.14	−0.375 (.125)***	3.12	3.29	0.178 (.107)*	−0.553 (.165)***	−0.543 (.174)***	−0.465 (.215)**	−0.449 (.228)*
N	104	104	104	146	146	146	250	250	250	250
Treatment effects – male										
Entrepreneur traits	5.98	6.02	0.038 (.092)	6.09	6.31	0.222 (.063)***	−0.184 (.111)*	−0.130 (.124)	−0.018 (.149)	0.044 (.163)
Need for achievement	7.18	7.30	0.135 (.119)	7.19	7.37	0.170 (.088)*	−0.035 (.148)	−0.018 (.154)	0.011 (.200)	−0.015 (.201)
Need for autonomy	5.46	5.80	0.347 (.165)**	5.83	6.03	0.194 (.140)	0.154 (.216)	0.104 (.229)	0.227 (.301)	0.165 (.321)
Need for power	6.20	5.93	−0.291 (.244)	6.32	6.54	0.228 (.178)	−0.519 (.302)*	−0.360 (.314)	0.099 (.398)	0.320 (.426)
Social orientation	6.30	6.29	−0.018 (.186)	6.38	6.46	0.099 (.151)	−0.116 (.240)	−0.072 (.260)	−0.083 (.325)	0.103 (.341)
Self efficacy	5.37	5.48	0.088 (.196)	5.47	6.00	0.533 (.141)***	−0.445 (.242)*	−0.303 (.266)	−0.291 (.316)	−0.079 (.340)
Endurance	6.23	6.28	0.082 (.135)	6.28	6.60	0.319 (.092)***	−0.237 (.163)	−0.230 (.173)	−0.201 (.224)	−0.252 (.251)
Risk taking propensity	5.12	5.07	−0.079 (.127)	5.15	5.17	0.013 (.096)	−0.092 (.159)	−0.033 (.172)	−0.113 (.209)	0.062 (.230)
Entrepreneur skills	5.92	5.87	−0.040 (.093)*	6.08	6.21	0.124 (.082)	−0.164 (.124)	−0.121 (.138)	0.019 (.171)	0.144 (.172)
Market awareness	6.20	6.19	−0.000 (.118)	6.61	6.66	0.053 (.129)	−0.053 (.175)	−0.030 (.207)	0.128 (.243)	0.217 (.288)
Creativity	6.08	5.96	−0.130 (.182)**	6.34	6.50	0.153 (.136)	−0.283 (.227)	−0.282 (.236)	−0.123 (.272)	0.045 (.308)
Flexibility	5.46	5.47	0.011 (.136)	5.31	5.47	0.166 (.095)*	−0.155 (.166)	−0.049(.176)	−0.051 (.245)	0.171 (.245)
Entrepreneur intentions (0–6)	3.88	3.62	−0.281 (.177)	3.48	3.70	0.228 (.127)*	−0.509 (.218)***	−0.422 (.228)*	−0.425 (.303)	−0.326 (.319)
N	57	57	57	79	79	79	136	136	136	136
Treatment effects – female										
Entrepreneur traits	6.08	6.07	−0.016 (.075)	6.03	6.08	0.051 (.059)	−0.067 (.095)	−0.065 (.099)	−0.195 (.122)	−0.172 (.121)
Need for achievement	7.42	7.30	−0.133 (.127)	7.18	7.31	0.146 (.087)*	−0.279 (.154)	−0.296 (.173)	−0.172 (.154)	−0.190 (.181)
Need for autonomy	5.84	6.20	0.335 (.161)**	5.99	5.99	−0.002 (.131)	0.336 (.207)	0.301 (.200)	0.103 (.257)	0.155 (.238)
Need for power	5.64	5.34	−0.272 (.205)	5.91	5.76	−0.163 (.205)	−0.109 (.290)	−0.118 (.285)	−0.353 (.346)	−0.309 (.348)
Social orientation	6.47	6.48	0.009 (.192)	5.83	6.03	0.195 (.146)	−0.187 (.241)	−0.114 (.262)	−0.315 (.313)	−0.275 (.337)
Self efficacy	5.20	5.48	0.239 (.160)	5.33	5.48	0.143 (.121)	0.096 (.201)	−0.150 (.217)	−0.176 (.245)	−0.055 (.273)
Endurance	6.63	6.57	−0.091 (.133)	6.48	6.69	0.251 (.083)***	−0.342 (.157)**	−0.429 (.168)***	−0.266 (.177)	−0.366 (.188)
Risk-taking propensity	5.39	5.17	−0.200 (.158)	5.50	5.30	−0.217 (.112)*	−0.017 (.193)	0.048 (.204)	−0.188 (.240)	−0.167 (.229)
Entrepreneur skills	5.91	5.71	−0.201 (.099)*	5.93	5.94	0.026 (.076)	−0.228 (.125)**	−0.144 (.133)	−0.165 (.154)	−0.110 (.163)
Market awareness	6.11	6.04	−0.076 (.166)	6.23	6.21	−0.023 (.122)	−0.053 (.206)	−0.014 (.221)	0.097 (.239)	0.063 (.242)
Creativity	6.08	5.60	−0.461 (.181)***	6.23	6.22	−0.017 (.137)	−0.444 (.227)**	−0.249 (.225)	−0.440 (.285)	−0.275 (.290)
Flexibility	5.54	5.49	−0.067 (.119)	5.32	5.41	0.118 (.102)	−0.186 (.156)	−0.169(.170)	−0.150 (.202)	−0.116 (.211)
Entrepreneur intentions (0–6)	3.08	2.54	−0.543 (.172)***	2.68	2.80	0.092 (.183)	−0.636 (.251)***	−0.891 (.261)***	−0.572 (.305)*	−0.970 (.330)***
N	46	46	46	65	65	65	111	111	111	111

Note: All effect estimates in the various rows of columns 7–10 come from separate regressions. Robust standard errors in parentheses. */**/*** indicates significance at the 10%/5%/1% level.

Table A1
Business economics and accountancy.

Treatment	Control

General
  Courses are provided within the following fields.
Curriculum
  Business economics, tax law, economics, finance, financial
  accounting.
Other
  The following competencies linked to the program are practiced,
  addressed and evaluated for each student: communication,
  integrity, presentation, customer mindedness.
	Students are provided with a combination of theory and practice
	assignments. Central focus are competencies.
	Business plan, tax law, economics, finance, marketing, ethics,
	entrepreneurial law.
	
	N/A

6. Conclusion

This paper analyzes the impact of the leading entrepreneurship education program on entrepreneurial competencies and intentions using an instrumental variables approach in a difference-in-differences framework. We exploit that the program was offered to students at one location of a school but not to students at another location of the same school. We instrument treatment by relative distance of parents' place of residence to the locations.

The results show that the program does not have the intended effect: The effects on students' self-assessed entrepreneurial skills (and traits) are not significantly different from zero and the point estimates are even negative. The effect on entrepreneurial intentions is significantly negative. This result stands in sharp contrast to earlier positive outcomes of assessments based on the appreciation of the parties involved.

The results can possibly be related to the fact that students have obtained more realistic perspectives both on themselves as well as on what it takes to be an entrepreneur. A more realistic self-perception may have caused the (insignificant) decreases in the traits measures among students in the treatment group relative to the control group. In the same vain, changes in self-perception might have caused the slight decreases in the entrepreneurial skill levels of program participants relative to non-participants as these are of the same order of magnitude as the changes in traits scores. However, the fact that these changes in self-perception are reflected in lower skill levels and are apparently not (at least) compensated by higher actual levels of these skills is worrisome and indicative of the ineffectiveness of the program at the school of our study.

The negative impact of the program on the intention to become an entrepreneur can be due to a more realistic view of what is needed to start an own business as was suggested in interviews that were held with lecturers and coaches. More indirectly, participants might have lost their (over-)optimism (as reflected in their lower self-perception) and this may have caused a lower interest in entrepreneurship.[14] Alternatively, the program participants may simply have disliked the program. Various factors may have contributed to that: participation is compulsory, the time and effort input demanded from participants is high relative to the credit points they earn, and the number of students per group is large (ten on average) which may hamper active involvement and may have caused some participants to free-ride.

The contribution of our study is that it is the first solid impact evaluation of the SMC program. However, the internal validity comes at a cost: the lack of external validity since we analyze the program in only one school. We do not base any policy implications on the results of just one study. The implication of our study is that more impact evaluations along the lines of our study should be conducted in collaboration with the schools in order to ensure a random allocation of students across treatment and control groups. Moreover, studies that assess the effectiveness of variants of the program in terms of aspects such as the entrepreneur team's size, the duration of the program, mandatory versus voluntary participation in the program and the number of student credit points earned would be instructive.

Appendix A. Detailed comparison of curricula of treatment and control study programs

This appendix describes the curricula of the four treatment study programs and control study programs. It also discusses links between the curriculum and the student company in the treatment programs (See Tables A1–A4).

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[14] A stylized fact in the entrepreneurship literature is that entrepreneurs are more (over-) optimistic than others (Parker, 2004, pp. 81–83).

Table A2
Management and law.

Treatment	Control
General Courses are provided in four categories: the company's beginning, its environment, the growing company and the controlled company. Students receive quite some freedom and a high degree of autonomy is required.	Subjects are provided in clearly defined courses.
Curriculum Courses provided in the company's beginning are: marketing/communication, fiscal/juridical, business economics/finance. Subjects provided in the company's environment are: the roles of governments, sustainable entrepreneurship, analysis of mission, strategy and targets, English. Subjects provided in the growing company are: juridical, finance, (human resource) management. Subjects provided in the controlled company are: planning and control, information systems, information gathering, qualitative and quantitative methods, written communication.	Marketing, communication, intellectual property, management accounting, information systems, market mindedness, purchase, contract law, suppliers' choice, logistics, English, administrative organization, risk analysis, activity based costing, quality control, production logistics, career competencies, writing a business plan, Mintzberg, fiscal law, accountancy, law.
Other Eight behavioral competencies are linked to the SMC program. These are evaluated for each student. In class, students are required to practice the competencies and address shortcomings. The competencies are: planning and organization, entrepreneurship, cooperation, initiative, controllability, oral communication and presentation, adaptiveness, result mindedness.	Before students take an internship the next year, they have to select one or more competencies that they want to improve. They have to construct learning goals which are then evaluated after their internship. These compentencies might correspond to the ten traits of entrepreneurship used in our study.

Table A3
Personnel studies.

Treatment	Control
General Subjects are provided in clearly defined courses. Attention is given to personal development and behavior.	Subjects are provided in clearly defined courses. Internship starts at the last period of the year.
Curriculum Personnel benefits, quantitative methods, communication in groups, Belbin, reward and evaluation, communication in advisory, labor law, personnel administration, Englsih, argumentation and presentation, developing organization and role of HRM, Bilateral conversations.	Logistics, Marketing, Financial accounting, Communication in advisory, Reporting to organization, Management accounting, Social security law, Bilateral conversations, Organizational environment, Mintzberg, HRM, Marketing.
Other Eight behavioral competencies are linked to the SMC program. These are evaluated for each student. In class, students are required to practice the competencies and address shortcomings. The competencies are: planning and organization, entrepreneurship, cooperation, initiative, controllability, oral communication and presentation, adaptiveness, result mindedness.	N/A

Table A4
Small business and retail management.

Treatment	Control
General There are no clearly defined courses, all subjects are fitted in competence enhancement and curriculum differs per student.	There are no clearly defined courses, all subjects are fitted in competence enhancement and curriculum differs per student.
Curriculum Information systems, administrative organization, requirements in terms of financial-economic and fiscal information for decision-making, stakeholder management, independent product or service initiation and creation, market, trend and SWOT analysis, marketing strategy and planning, sales management, communication in different languages and cultures, leadership, development of vision, policy analysis, HRM, business processes, communication processes, interpersonal competences, intrapersonal competences.	Communication of vision and strategy, managing of and making policy for organizational resources, organizational culture, sustainable entrepreneurship, networking, profitability through market mindedness, result mindedness, professional attitude, creativity, self reflection, innovation, strategic behavior, structuring, projects and planning, situation analysis, customer mindedness, work relationships and hierarchy, cooperation, responsibility.
Other N/A	N/A

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