

Bosio, Giulio; Origo, Federica

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Who Gains from Active Learning in Higher Education?

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DISCUSSION PAPER SERIES

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JUNE 2019

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Giulio Bosio

University of Bergamo

Federica Origo

University of Bergamo and IZA

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IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Who Gains from Active Learning in Higher Education?¹

The aim of this paper is to study whether and how teaching style (i.e., traditional vs active mode) affects academic performance of young individuals in tertiary education. We focus on entrepreneurship education as an ideal subject for experimenting alternative teaching methods. Identification relies on Triple Differences (DDD) estimates based on detailed administrative data for the universe of students in a Master's program in Management and Finance in Italy over 2011-2015. We measure academic achievement through several indicators, both right after the end of the entrepreneurship course (short run) and at the end of the program (long run). Our preferred estimates show no significant effects of the teaching mode on student's achievement, both in the short and in the long run. However, further estimates reveal interesting heterogeneities across students, being active teaching more effective in the case of females and students from secondary schools with an academic track.

JEL Classification: I20, J24, L26

Keywords: entrepreneurship education, teaching modes, academic performance, triple difference, difference-in-differences

Corresponding author:

Federica Origo
Department of Management, Economics and Quantitative Methods
University of Bergamo
Via dei Caniana 2
24127 Bergamo
Italy
E-mail: federica.origo@unibg.it

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1. Introduction

Research on educational production functions has pointed out the role of teacher quality in favoring students learning and raising their academic achievement (Rivkin et al. 2005; Hanushek et al. 2010). However, there is no strong evidence of any effect of observable teacher characteristics, such as gender, race, experience, credentials and training, on students outcomes, albeit such characteristics are highly correlated with teachers' compensation (Dee, 2005 and 2007; Hanushek 1992; Boyd et al. 2006; Kane, Rockoff, and Staiger 2006; Harris and Sass, 2011). In light of this evidence, quite recently there has been a shift in empirical research from what teachers are (in terms of observable characteristics) to what teachers do, trying to identify the teaching practices that matter most to student achievement and, in turn, to learning environment (Falck et al. 2018; Dobbie and Fryer 2013). Many studies have found that teaching style matters, but empirical evidence is not conclusive as regards the comparative effectiveness of modern and traditional practices. Using data from Pakistan, Aslam and Kingdom (2011) find that a large number of process variables, such as asking questions from pupils during lessons or quizzing students on past lessons, raises pupil mark. Schwerdt and Wuppermamm (2011) use data on a representative sample of 8th grade US students and show that a shift from problem solving to lecture style presentation results in an increase in student achievement. Van Klaveren (2011) finds no relationship between the proportion of time that teachers spend on lecturing style teaching and the performance of Dutch students who are in their second year of secondary school. Lavy (2011) finds that both traditional-style teaching (classroom teaching that emphasizes the instilment of knowledge and comprehension) and modern-style teaching (use of techniques that endow pupils with analytical and critical skills) have a strong positive effect on pupil achievement. More recently, Kornel and Paulus (2017) use TIMMS data on 8th grade Czech students and show that "modern" teaching practices, such as working in small groups, positively influence both test scores and non-cognitive skills, especially motivation and self-confidence. On the contrary, standard practices such as lecturing or requiring students to memorize concepts have no impact on either these skills or test scores.

A potential concern in this line of research is that most of these studies focus on primary or secondary education and they usually identify the effect of the teaching style by

comparing different subjects (for example, reading with math, math with science), which differ also in the extent to which they can be taught effectively in an active way.

Furthermore, a number of studies identify the effect of teaching style by exploiting students' perceptions, but also this approach may lead to questionable results as long as perceptions related to the effects of in-class work could be different between teachers and students. For example, Hidalgo-Cabrillana and Lopez-Mayan (2018) analyze the effect of teaching styles on student achievement in primary education in Spain, considering at the same time the perspective of the teachers and their students. They find that modern practices are significantly associated with better achievement, but only if they adopt students' perspective. Interestingly, the authors also detect the presence of relevant heterogeneities between boys and girls as well as depending on the socioeconomic background of the student.

In order to overcome these limitations, in this paper we focus on entrepreneurship education at the University level, looking at how the same course taught with different styles influence students' academic performance both right after attending the course (short run effects) and at the end of their master's degree (long run effects).

We believe that entrepreneurship education is the ideal candidate for studying the effect of different teaching modes on students' achievement because most of its contents (such as how to identify business opportunities, how to write a business plan or how to start up a new business) can be effectively taught in quite different ways (Rasmussen and Sorheim 2006; Van der LUIS et al. 2008; Kerr et al. 2014). Additionally, entrepreneurship education aims to influence entrepreneurial attitudes (Fayolle 2013) and non-cognitive skills, therefore stimulating the adoption of innovative practices in the educational process.

In this respect, Walter and Dose (2012) identify two main broad methods of teaching entrepreneurship: the traditional (or reflective) ones, where students acquire knowledge and skills through reflective observation, and the active ones, where students acquire knowledge through active sedimentation. The first teaching modes include frontal lectures, videos, case studies and discussions, while the second ones encompass a wide

range of activities, such as simulations, experiments, role-plays and other types of fieldwork.²

Notice also that traditional teaching includes also some practices, such as in-class discussion, that are usually considered as active practices, especially in primary and secondary schools and in the case of more standard subjects (such as reading and math).

The two teaching styles should pursue also different objectives: while traditional modes aim at changing knowledge and conceptual skills, active modes should influence more understanding, practical skills and attitudes. Traditional modes are usually based on contents that can be easily verbally explained and/or captured in writings and drawings, thus creating explicit knowledge. On the contrary, active modes, by encouraging personal experience and learning by doing, should influence more tacit knowledge and intuition, including senses-based knowledge and rule of thumbs (Nonaka and von Krogh, 2009). An ongoing debate (Bietenbeck 2014; Algan et al. 2013) has emphasized how alternative teaching styles can promote different cognitive and non-cognitive skills among students. Therefore, understanding how traditional and active teaching practices foster students' learning represents an important issue (Scott Cardell et al. 1996; Emerson and Taylor 2004).

Regardless the teaching mode, the main goal of entrepreneurship education is to promote general and specific entrepreneurial skills (von Graevenitz et al., 2010), i.e. those personal attitudes, social skills, self-confidence and creativity that may drive the individual decision to pursue a business activity as well as the capacity to innovate (Johansen, 2014). Existing empirical evidence on the effect of entrepreneurship courses on entrepreneurial intentions and skills is mixed. Indeed, some studies argue that entrepreneurship education raises the interest in entrepreneurship as a career option (Souitaris et al., 2007), while others yield opposite results (Oosterbeek et al., 2010; von Graevenitz et al., 2010).

² Notice that active modes could in principle include any activity in which the student has an active role, such as homework, but, in practice, they require that the activity is done in the classroom (Prince, 2004). Furthermore, there are some forms of cooperative learning, such as teamwork, that can pertain to either active or traditional teaching modes. For example, teamwork requiring the students to read and present papers is close to traditional teaching modes, while teamwork requiring to simulate the start-up of a new business can be considered like an active teaching mode.

However, the impact of entrepreneurship education may actually go beyond entrepreneurial intentions and business start-ups, since it should provide knowledge and skills that may be useful to young people while they study or if they end up working as employees in existing companies or organizations.

While there is a large body of literature on the effects of entrepreneurship education on the creation and performance of new start-ups (Elert et al. 2015), little is known on the implications of such type of education on the academic performance of young people in tertiary education.

This aspect is relevant for a number of reasons. First, entrepreneurship is usually taught in formal (university) courses and, as such, it should influence knowledge and skills that may be useful to students also during their academic careers. For example, learning how to write a business plan may help students to organize better their study plan and to use more efficiently their time. Second, since academic performance is a key determinant of future labor market outcomes, the impact of entrepreneurship education on academic achievement can be used as a leading indicator of longer-run effects in terms of labor market performance. For example, empirical evidence shows that the time to degree significantly influences employment opportunities, but obtaining a college degree within normal completion time is becoming the exception rather than the norm both in the US and throughout Europe (Garibaldi et al., 2012; Bound et al. 2009). Finally, entrepreneurship education is one of the few courses that allow students to make them learning by doing through in-classroom simulations of entrepreneurial activities, such as the simulation of a business start-up. From a pedagogical point of view, a more active teaching mode may create a deeper learning experience (Zantov et al., 2005) or impact complex competencies more quickly than traditional frontal lectures (Salas et al., 2009), with subsequent effects on academic performance.

The aim of this paper is hence to empirically study whether and how the teaching mode of entrepreneurship education affects the academic performance of young individuals. We base our empirical analysis on detailed administrative data from a medium-sized university in the North of Italy, where entrepreneurship education is getting more and more relevant, particularly in the departments/degrees with a management vocation. We measure academic achievement through several indicators, both right after the treatment

(such as the average mark at the end of the first year of the program) and at the end of the program (the final mark). In order to identify a causal effect of the teaching mode of entrepreneurship on students achievement, we exploit the features of the plan of studies of a Master's degree to build a sort of "quasi natural" experiment. More specifically, we exploit the fact that a Master's degree in management, which has a compulsory entrepreneurship course, is offered both in Italian and in English. The main difference between the two programs, other than the official teaching language, is the way in which entrepreneurship is taught: while the entrepreneurship course in the English program provides a set of practical elements related to entrepreneurial skills, the correspondent course in the Italian curriculum mainly relies on a set of normative rules and procedures related to the entrepreneurial career. Furthermore, the same Master's program offers also a curriculum in finance (both in Italian and English) whose study plan does not include a compulsory course in entrepreneurship. We use the finance curriculum to disentangle the effect of the teaching style from that of the teaching language. Hence, we exploit this setting in a triple difference (DDD) framework, in which the treatment is the intensity of the active contents of the entrepreneurship course and we use students enrolled in the curriculum with no entrepreneurship course to control for potential self-selection of the teaching language. As a robustness check, similarly to Leuven et al. (2007) and to Oosterbeek et al. (2010), we also perform IV diff-in-diff estimates, using pre-treatment information on both English proficiency and study-related mobility as instruments for the choice of the Master's program on the basis of the teaching language.

Our results indicates no significant effects of the teaching style on student achievement both in the short and in the long run. However, further estimates reveal large differences across college students: in particular, females and students from secondary schools with an academic track gain more from active teaching mode. Our findings can help reconcile some of the diverging patterns in this stream of research, with most studies finding little to no effect of active teaching styles.

The remainder of the paper is structured as follows. In Section 2 we present the data used in the empirical analysis and the institutional context characterizing the Master's program under investigation. In Section 3 we discuss the empirical strategy, while the empirical results are reported in Section 4. Section 5 provides a discussion of potential additional identification issues and a set of robustness checks. The last Section concludes.

2. Data and Institutional context

The empirical analysis is based on longitudinal data from five cohorts of college students who started their master's degree careers from 2011 to 2015 in a medium-size public university in Italy.

Specifically, we select students enrolled in the Master's degree in Management and Finance because it is the only teaching program that since academic year 2011/2012 offer the possibility to choose between two curricula taught both in Italian and in English, respectively Management and Entrepreneurship (hereafter named "*Entrepreneurship*" track) and International Business and Finance (hereafter named "*Finance*" track).

Each curriculum requires taking a sequence of compulsory and elective courses spanning the entire duration of the two-year program.

The *Entrepreneurship* track refers to management and entrepreneurship issues faced by organizations and firms, in order to compete in challenging international markets. Hence, the objective of this track is to offer students a set of skills that, on the one hand, facilitate participation in entrepreneurial teams and the development of new business and, on the other hand, help to pursue a career path in several corporate functions requiring international openness, attitude to change and cross-functional knowledge. Contextually, the *Finance* track addresses the role of multinational firms in a context of global competition, with a special focus on finance and international business. The objective of this curriculum is therefore to provide the necessary skills to operate in financial markets and to adapt corporate strategies to different needs and environments in the international competition.

The two curricula have similar plans of studies in the first year, with some common compulsory exams. However, the entrepreneurship course is included only in the *Entrepreneurship* track as a compulsory exam of 12 ECTS, while the *Finance* curriculum offers a corresponding specific course of 12 ECTS in Financial Markets and Institutions.

Notice that the English version of each curriculum includes exactly the same courses offered by the Italian one. However, one main difference concerns the teaching method for the entrepreneurship exam, which is more active in the English program, based on students' participation and the definition of a business plan and more normative in the

Italian program, based on traditional lectures and a normative approach. These differences are clearly spelt out in the official syllabus of the two courses (Panel A of Table 1). While both courses are aimed at teaching students how to start-up a new business from the definition and development of a business idea, the degree of students' involvement and commitment in the class activities is clearly much higher in the English course (which refers also to the concept of a "bootcamp") than in the Italian one. Clear-cut differences emerge also in the teaching activities. The Italian course is mainly based on frontal lectures, with active teaching consisting of traditional teamwork and discussions with professionals. On the contrary, the English course claims to offer an innovative approach, in which students meet only once a month with the instructor but are continuously asked to participate actively in different projects and workshops, individually and in groups, to learn "hands-on". Overall, the teaching language does not convey what students should learn, but how entrepreneurship should be taught (Duval-Couetil, 2013).

On the opposite, we do not find any difference in the teaching methods concerning the other first year courses such as International Business between English and Italian curricula of the Entrepreneurship track, as shown by the official syllabus of the two courses reported in Panel B of Table 1. Indeed, both courses that account for 12 ECTS are based on frontal lectures, with additional teaching activities consisting in operational researches, assigned written exercises and discussions.³

More precisely, our identification strategy exploits the fact that Entrepreneurship Bootcamp in the English curriculum represents the only course in the academic years 2011-2015 which implemented active teaching styles to promote students' participation and new learning experiences, while other courses in the English curriculum and, in general, the Italian one clearly rely on traditional teaching methods, providing an ideal context to test whether and to what extent alternative teaching styles could benefit college students' achievement.

Insert Table 1 here

³ The same teaching activities in this course are adopted in the English and Italian curricula of Finance track.

Using university-level data from a single Master's program provides a more homogeneous setting and reduce potential confounding effects due to unobserved heterogeneity (Oosterbeek et al., 2010; von Graevenitz et al., 2010). In a similar vein, entrepreneurship education reflects a peculiar subject in the teaching supply and, in particular, supporting student entrepreneurship is a significant part of the selected university's self-declared mission, not only offering support for those college graduates who intend to start-up their own business, but also promoting and encouraging entrepreneurial initiatives and pro-active environment (Di Gregorio and Shane 2003). Precisely, this institutional attitude emphasizes the role of entrepreneurship courses as natural candidates to experiment various pedagogical techniques and more differentiated learning contexts.

Our data cover the entire academic career of the universe of college students, including a number of pre-treatment controls that may influence both the selection into a specific curriculum as well as students' achievements, such as individual characteristics (gender, place of birth and area of residence), high school final mark as well as the type of high school attended. Importantly, we also observe term-by-term information concerning credits earned, academic performance in each single exam (GPA) and time to degree completion. We have also access to graduation marks for all students who earned the Master's degree.⁴ Since pre-treatment information on academic achievements is available only for students who earned their bachelor degree in the same University, we base our empirical analysis on this sample of students, for whom we observe information on the specific bachelor degree obtained as well as the grades in each single exam they passed and the corresponding credits. They represent approximately 70 per cent of the total sample of students enrolled in the Master's program under investigation.⁵

We also exclude students who enrolled from 2016 onward, since none of them could have completed their studies and earned the Master's degree by the end of our observational

⁴ Using the date in which students obtained the degree, we are also able to measure study duration and to recognize those who have finished within legal time.

⁵ Concerning differences in observable characteristics between the universe of Masters' students and the selected sample, the composition by gender, high-school type and final mark is substantially the same. As expected, the share of students living in the same province of the university is higher in the selected sample with respect to the total population of Master's students (respectively 97% vs. 88%).

period. The final sample consists of 562 college students, of which 245 in the English programs (both Entrepreneurship and Finance tracks).⁶ In summary, our core estimation sample corresponds to students with non-missing values in key baseline characteristics, coherently with the logic of our empirical strategy.

Table 2 reports summary statistics for college students in our sample, both for the entire sample and by curriculum and teaching language. Column (1) refers to the full sample. Columns (2) and (3) refer to the sample of students enrolled in the Entrepreneurship track, respectively in the Italian and English program. Similarly, Columns (4) and (5) consider students enrolled in the two programs (i.e., Italian and English) of the Finance track. Descriptive statistics show that gender composition is quite similar across curricula and teaching languages, but students in the Entrepreneurship track are more likely Italian citizens and resident in the same province in which the University is located, in particular those enrolled in the English program (respectively 97 and 87 percent).

Information on high-school background and grades as well as on the bachelor degree provide potential indicators of individual ability. More specifically, data in Table 2 indicate that, on average, the *Finance* track, regardless of the teaching language, attracts better students in terms of high school marks. In a similar vein, students enrolled in the English programs, regardless of track, are more likely to come from an academic-oriented high school (lyceum) and to hold a bachelor degree in Management.

Insert Table 2 here

As outcome variables, we measure academic achievement through two indicators: the average mark at the end of the first year of the Master's program (i.e., right after the treatment) and the final mark at the end of the program. We interpret the former as a short-run college outcome, while the latter reflects a long-run academic achievement. This choice has been motivated by the relevance of time dimension in determining the effectiveness of teaching styles based on active students' participation and innovative pedagogical technique.

⁶ Our final sample includes graduates, students who are still enrolled in the Master's program and drop-outs.

3. Empirical strategy

The aim of the empirical analysis is to estimate the causal impact of alternative teaching styles in entrepreneurship courses on college students' achievement, comparing the outcomes of interest for those who did experience active teaching methods characterized by student-centered learning (the treated group) with that of those exposed to more traditional lectures in the same course (the control group). Hence, both groups have attended the entrepreneurship course, but the treated group includes all the students that took the course taught in English, while the control group are students that attended the Italian one. For all students, we observe the outcome variables both before and after the treatment.

In this setting, we should take into account of potential self-selection of student of the teaching language. Hence, standard OLS estimates may not fully control for potential selection issues associated with non-random assignment of students to a specific course.

As a preliminary identification strategy, we rely on the institutional setting discussed above and on the pre-treatment information about college students' outcomes related to the Bachelor degree, applying a difference-in-differences (DD) framework. Notably, the entrepreneurship course in the English program has more active contents than the corresponding course in the Italian one. Hence, the treatment is the intensity of active modes in teaching entrepreneurship.

In the DD approach, we start by comparing students from both English and Italian curricula within the Entrepreneurship track and estimate the following equation:

$$y_{it} = \alpha + \beta_1 Treated_i * Post_t + \beta_2 Post_t + \mu_i + \varepsilon_{it} \quad [1]$$

where y_{it} identifies an indicator of academic performance for student i at time t , $Treated$ is a dummy for students taking an active entrepreneurship course and $Post$ is the period after the treatment. In order to control for selection driven by time invariant individual characteristics, in our preferred specification we also include individual fixed effects μ_i .

Given the richness of our administrative data in terms of pre-treatment individual characteristics, we also estimate a specification without students' fixed effect with robust standard errors clustered at the individual level to account for potential correlation of error terms within individuals. Pre-treatment controls include: gender, citizenship, area of residence, high school type, high school final mark, years since high school graduation, the major of the Bachelor degree and the status of late students during the Bachelor degree.

Notice that the identification strategy with a DD estimator relies on the so-called parallel trend assumption. Ideally, our parallel trend assumption implies that the change in the outcome for treated students, in case of non-treatment, would have been the same as that experienced by students in the control group. However, students' choice of the English course might not be random and it may also influence the evolution of the outcome variables over time, regardless of the treatment. In particular, some individuals may have higher abilities or skills in terms of English proficiency and could actually self-select into the English course. Furthermore, young students who are less adverse to risk and changes are more likely to self-select into active entrepreneurship courses (Oosterbeek et al., 2010). These (unobserved) characteristics are also likely to influence students' participation in international mobility programs (such as the Erasmus one) in the bachelor degree and then subsequent self-selection into English courses at the Master's level. Under these assumptions, compared to students who took the entrepreneurship course taught in Italian, students in the English course may then experience different trends in the outcome variables because of their unobservable characteristics, also without attending a more active Entrepreneurship course. In this perspective, self-selection into, respectively, a more innovative or a more traditional Entrepreneurship course on the basis of the teaching language can threaten the parallel trend assumption.

To tackle this potential identification threat, we exploit as a further control group students in the *Finance* track (also taught both in Italian and English) to take into account of potential different time trends in the two language programs. More precisely, we estimate a triple-differences model (DDD) specified as follows:

$$y_{it} = \alpha + \beta_{1DDD}English_i * EE_i * Post_t + \beta_2English_i * Post_t + \beta_3EE_i * Post_t + \beta_4Post_t + \mu_i + \varepsilon_{it} \quad [2]$$

The main coefficient of interest (DDD estimate) is now β_{1DDD} , which should capture the causal effect of an active mode of teaching entrepreneurship compared to a more traditional one, taking into account that students enrolled in an English program may experience a different trend in the outcome variables compared to students enrolled in an Italian one also in the absence of the treatment.

Notice that, even if we consider as “treated” all the students with the entrepreneurship course taught in English in their study plans, some students may have not attended it yet by the end of the first year of the program. This is because in the Italian University system, courses are formally associated to different terms and years of the program (for instance, the entrepreneurship course is formally offered in the first term of the first year of the Master’s program), but students are free to take them whenever they want, unless some courses are pre-requisites for other advanced courses in the following years. Hence, our quasi-experimental design is based on the initial assignment and not on the treatment actually received. In this light, estimates on short-run effect should be therefore interpreted as an “intention-to-treat” (ITT) effect, since there could be imperfect compliance within the treatment group.⁷

In this perspective, the ITT approach is often emphasized in the program evaluation studies as a practical solution to the problem of imperfect compliance. The intuition is that the ITT identification strictly relies on the initial treatment assignment and ignores all sorts of non-compliance in the post-protocol period. The ITT effect tends to be generally smaller in size than the standard average treatment effect (i.e., it likely underestimates the true causal effect of interest), because of imperfect compliance (Angrist and Pischke 2008). Hence, although it can be interpreted as a sort of lower-bound estimate, the ITT is more relevant with respect to policy implications than the average

⁷ This is not the case when we consider long run outcomes, since students have to pass all the exams to graduate. In this case, our estimates may be interpreted, more generally, as the effect of the entire entrepreneurship track rather than of a single entrepreneurship course, even if the focus on the active teaching style is still working.

treatment effect (ATE) parameter in the empirical analysis of “voluntary” programs (Bloom 2008).

4. Main results

In this section, we present our main empirical results for the impact of active teaching styles in entrepreneurship courses on college students’ outcomes. We concentrate on two main indicators to identify to what extent student-centered teaching methods (with respect to more traditional and normative ones) can influence academic performance. More specifically, as dependent variables, we examine short and long run educational outcomes, looking respectively at the average grade at the end of the first year of the Master’s program and at the final grade at the end of the Master’s degree. For each outcome, we discuss results from the *difference-in-difference* (DD) approach and the *triple difference* (DDD) specification.

Then we investigate potential differences by gender and high school background.

Difference-in-difference results

Estimation results of Eq. (1) reporting difference-in-difference estimates of both short- and long-run educational achievements are presented in Table 3. In order to account for potential concerns about factors influencing both course selection and academic performance, we present both pooled OLS estimates with and without the set of controls capturing relevant students’ characteristics (columns 1 and 2) as well as fixed effects estimates (column 3). Precisely, in column 2 we control for individual pre-treatment characteristics (gender, age and the status of Italian citizen), cohort fixed effects, area of residence,⁸ a dummy for the specific Bachelor degree obtained and information concerning high-school types (academic, technical and professional) and final high school grade.

Each panel displays the results of separate regressions for the correspondent outcome, providing the main parameter of interest, i.e. the DD coefficient that captures the specific

⁸ We distinguish between those resident in the same province of the university, those resident in the same region and the others (i.e. the reference category).

gain associated to the active teaching style. To allow for within-individual correlation of error terms related to repeated observations, we cluster standard errors in the pooled models at the individual level.

Overall, the results in panel A seem to indicate a sizeable impact of student-centered learning style in entrepreneurship course on the average grade at the end of first year of Master's degree, even if the effect is weakly statistically significant. All coefficients are positive and the magnitude is quantitatively similar as we add controls in our pooled model or when we move to specification including students' fixed effects in column (3), suggesting that the positive impact of teaching methods relying on active students' participation is robust to the inclusion of further controls or to individual unobserved heterogeneity. According to our estimates, attending an active entrepreneurship course increases the average mark at the end of the first year of the program by around half a point on a 30-point scale, corresponding to almost 2 percent of the average mark.

In Panel B, we concentrate on the long-run educational outcome, replicating the same set of regressions. Again, estimates suggest a positive effect of modern teaching methods, although the coefficients are not statistically significant. Furthermore, even if the size remains similar across specifications and the estimated effect is around half a point, the final grade is measured on a 110-point scale. Hence, the size of the effect, compared to the average final grade, is almost negligible (around 0.5 percent of the average final grade).

Insert Table 3 here

Triple difference results

As argued above, it should be noted that the estimates of β_1 reported in Table 3 may not provide a causal relation if unobserved differences between students taking, respectively, the English and the Italian Entrepreneurship course systematically influence also potential trends in their academic performance. In this case, differences in college achievement between the two groups of students may arise even if the teaching styles adopted in the entrepreneurship course were the same in both programs. We are not able to observe this counterfactual scenario, but we can control for selection into the teaching language by

exploiting as an additional control group the sample of students in the Finance track (that is offered both in Italian and in English) and estimate a triple-difference specification. Hence, we enlarge our sample including students in this additional curriculum and we estimate a triple-difference model to tackle potential threats to the parallel trend assumption in standard DD estimates.

Table 4 summarizes the results from the triple-difference strategy, using the same set of regressions as in Table 3 and reporting estimates for the pooled model with and without further controls (columns 1 and 2) as well as for a longitudinal model with the inclusion of individual fixed-effects (column 3). Our key parameter of interest, β_{1DDD} , allows us to take into account omitted variables that may differentially affect the changes in college achievements between students with different teaching language as well as between the two curricula. In particular, the results concerning short-run college achievement in Panel A show that the coefficients associated to triple-difference exhibit positive signs across all specifications, which is in line with previous DID results. Yet, none of them is statistically significant, corroborating the idea that teaching styles based on the active students' participation did not consistently increase college performance on average. In addition, the size of the effect is around 0.32-0.36 for all specifications, smaller than the magnitude reported in DD estimates.

When we focus on long-run outcome in Panel B, we find positive coefficients with highly different magnitude across alternative specifications, but they are not statistically significant for both pooled (columns 1 and 2) and fixed-effects (column 3) models. Overall, these estimates indicate that the academic performance of college students seems to be unaffected by the active teaching modes of entrepreneurship course. Additionally, this also suggest that, once we identify the impact of teaching methods in entrepreneurship education under more credible assumptions, the estimation results do not reveal, on average, any substantial differences in college achievements between students who benefit from innovative teaching experience and students who attended a more traditional entrepreneurial training. However, the somewhat low degree of precision

of our estimated coefficients could be associated to the clustering of standard errors at the individual level.⁹

To sum up, our DD estimates indicate that teaching styles relying on the students' active participation may have some positive impact on the short-run college achievements, although these results have to be considered cautiously, as the specific effects of innovative teaching styles may be biased by self-selection into the teaching language. Overall, once we take into account of this source of potential bias with a DDD approach, we can conclude that, in general, students exposed to more active teaching practices in the Entrepreneurship course do not face a consistent improvement in their academic performance.

However, point estimates of average negligible effects may be a result of positive effects for some sub-groups of students and negative or null effects for others. Notably, we explore this possibility of substantial differences in the effectiveness of active teaching methods across alternative subgroups of students in the next Section, while we conduct several sensitivity checks to test the robustness of our preferred empirical specification in the section 5.

Insert Table 4 here

Heterogeneous effects

Overall, previous estimates do not show a significant average effect of active teaching styles in entrepreneurship course on academic achievement, although findings are not entirely clear-cut and small impact sizes in the short-run cannot be completely excluded. Notably, these aggregate results could hide potentially relevant differences by group of students. Indeed, even if the analysis of differential effects by students' characteristics is

⁹ Using as a long-run academic outcome the mean grade at the end of Master's degree without considering the extra-points (up to 4) attributed to the discussion of the final dissertation, the results (available upon request) are qualitatively the same: we do not find any statistically significant effect of active teaching style on long-run students' performance.

still an almost unexplored issue in the literature, they gain relevance in a policy perspective.¹⁰

In particular, given that a long-standing stream of literature addressing the observed gender differences in the start-ups rate (Koellinger et al. 2013; Minniti 2009) has emphasized how women have traditionally different entrepreneurship-related attitudes with respect to men, investigating potential effect heterogeneity in the relationship between innovative teaching styles in entrepreneurship courses and academic performance by gender could be of crucial interest. For this reason, we replicate triple-difference analysis on both short- and long-run educational outcomes, separately for females and males. Estimation results by gender are summarized in Table 5, using the same set of regressions as in Table 3. Overall, the estimates for the triple interaction coefficients in Panel A clearly indicate that the impact of active teaching methods in entrepreneurship education on the short-run academic achievements is almost entirely related to female students, while there is virtually no effects for male students. In addition, the magnitude of this effect for females is similar across specifications and consistently higher than those found for the aggregate sample, suggesting that innovative teaching modes in entrepreneurship can benefit mostly female students, stimulating their participation in this educational training and potentially reducing traditional gender gaps (Furdas and Kohn 2010).

Insert Table 5 here

More interestingly, the results in Panel B show how for females the impact of teaching styles based on students' active participation persists also in the long run, as shown in column (3). Indeed, the coefficients associated to the specification including individual fixed effects is positive and weakly statistical significant, implying that the effect of active teaching styles is even more pronounced in the case of female students. In line with previous findings, coefficients for males are negative but statistically not different from zero. This might indicate that gender differences reflect an important source of heterogeneity. Male students seem to cope less well with the active learning context; this

¹⁰ As stressed by Huebener et al. (2017) about the impact of additional instructional hours on students' performance, detecting heterogeneities in the effectiveness of school input factors is even more important for policy makers in a context of scarce resources.

may potentially enhance gender inequality in students' performance, provided that female students have on average better grades than male peers.¹¹

In a complementary way, we explore whether modern teaching methods in entrepreneurship education differently affect students with different high-school background (Newhouse and Beegle 2006; Cappellari 2004). Hence, we split the sample between those students who attended academic high school (lyceum) and those with a technical high-school background. Estimates in Panel A of Table 6 show that student-centered learning methods in entrepreneurship education seem to positively influence short-run academic outcomes mainly for students from high schools with an academic track. The effect size is similar to those found for females and statistically significant across all specifications. In contrast, students coming from technical high schools do not benefit from active teaching styles: in all specifications the estimated short-run effect is negative but not statistically significant. However, regardless of high school background and consistently with aggregate DDD estimates, we do not find any robust evidence that active teaching styles matter also in a long-run perspective.

Insert Table 6 here

5. Robustness checks: an IV-DD approach

In previous section, we argue that our triple difference (DDD) approach provides more reliable estimates than a DD estimator, given that unobserved factors affecting the common trend assumption between English and Italian entrepreneurship courses may bias our main results.

As an alternative strategy to take into account for students' self-selection into a certain entrepreneurship course on the basis of the teaching language, we combine the difference-in-difference estimator with an instrumental variable approach. In the literature this approach has been already used by Oosterbeek et al. (2010), who estimated an IV diff-in-diff (IV-DD) model to evaluate the effect of entrepreneurship education on

¹¹ Notably, gender differences in the relationship between teaching practices and academic achievement are of particular interest for policy makers, given that differential effects could consistently enlarge existing inequalities and therefore should be taken into account when universities discuss whether to introduce or not innovative pedagogies in their teaching supply. See Dahmann (2017) for a discussion on the relevance of gender differences in evaluating changes in instructional time as well as in the timing of instruction.

entrepreneurial skills and motivations by comparing students enrolled in a Dutch University site offering such course with student enrolled in another University site not offering it. They used the distance of the University sites from students' home as instrument to take into account of potential endogeneity of the location choice.

In a similar vein, given our institutional context, we exploit information on past Bachelor career to create two “distance-related” instruments for the teaching language choice. On the one hand, we rely on the timing of the English test that students had in their first degree, by capturing whether they passed or not the test in the same academic year in which it has been formally offered.¹² As a second instrument, we compute a dummy variable based on any potential experience abroad in a mobility program offered by University (e.g. Erasmus or other international mobility programs). The intuition is that these exclusion restrictions could account for those unobservables related to both English fluency and entrepreneurial attitudes and mindset that can make English courses more attractive with respect to the Italian ones. The identifying assumption is that, conditional on a large set of control variables related to potential ability indicators, the two instruments are unrelated to the error term in the outcome equation.

Table A1 in the Appendix reports our first stage regression about the choice of the Entrepreneurship course taught in English, using a linear probability model with robust standard errors. As exclusion restriction, column (1) includes the dummy variable related to the timing of the English exam during first bachelor degree, while column (2) controls for a mobility indicator, capturing whether the student has done an experience abroad during the bachelor. Lastly, in column (3) we provide a specification including both instruments. One of the requirements for valid instruments is that they should significantly influence the choice of attending the English course. In this light, the results confirm how the instruments significantly affect this choice, both individually and jointly. Specifically, point estimates show that passing later the English exam at the Bachelor degree reduces the probability of attending English courses, while studying abroad for at least a term during the Bachelor degree increases this probability.

¹² At the end on the English Course in the Bachelor program, students get only a “pass/no-pass” evaluation. Hence, we cannot use the final mark in this course as a measure of pre-treatment English proficiency

Following a similar structure, Table 7 reports the main second stage estimates based on the IV-DD approach for the sample of students enrolled in the Entrepreneurship track. In Column (1), we use as instrument the timing associated to the English exam during the bachelor studies, while Column (2) relies on the indicator capturing potential experience abroad. Finally, in column (3) we include both exclusion restrictions. Estimation results in Panel A reveal that correcting for potential self-selection into teaching language provides estimates for short-run college achievements that are similar to previous triple difference findings. Indeed, the coefficients for all specifications are not statistically different from zero. Concerning the long-run academic outcome in Panel B, we find a negative and not statistically significant effect associated to active teaching practices regardless of the set of instruments used in the first stage.

Insert Table 7 here

Overall, our results point out that, once self-selection into the teaching language is taken into account, we do not find a statistically significant effect of teaching methods relying on active students' participation, regardless of the estimation strategy adopted. However, positive effects may still arise for specific sub-groups of students, especially females and those with an academic oriented high school background.

A potential concern is related to non-random assignment of college students to teachers. Indeed, teachers may decide to introduce active teaching styles according to their observable and unobservable specific characteristics. In particular, we could assume that teachers' unobservables are positively related to teacher ability and to the adoption of active teaching methods and, in turn, to students' performance.

In this perspective, the positive effect of innovative teaching styles in DD estimates may also capture the effect of teacher quality on students' achievement. However, if teachers in the Italian and English curricula of both tracks have a similar distribution of unobservables, then the potential bias related to teacher quality would disappear in the within student DDD estimates. In other words, if differences in unobserved teacher characteristics are not related to being in a specific curriculum, they are accounted for in our triple difference estimation strategy that controls also for curriculum and track fixed effects. Moreover, a consistent share of teachers are the same in both curricula as well as teachers who adopted active teaching styles in Entrepreneurship bootcamp course taught

in a traditional way in other courses in the Entrepreneurship track. These two factors could diminish the potential bias.

As an additional robustness check, we replicate our DDD model by including the interaction between cohort and curriculum fixed effects in order to capture the potential variation in the teacher quality across cohorts and curricula. Again, the estimates are substantially unchanged.

6. Discussion and Conclusion

In this paper, we studied the effects of teaching styles on students' academic achievement. Differently from previous studies, we considered a number of students' outcomes after attending the same subject taught in different ways at the University level. More specifically, we focused on entrepreneurship education, which is the ideal candidate for this type of analysis, since it can be effectively taught both in a traditional and an active way.

We exploited the institutional setting of a specific Master's program offered at a University in Italy, combined with detailed administrative data on the population of students attending this program since 2011, to build a quasi-natural experiment and estimate both difference-in-difference (DD) and triple difference (DDD) models. We focused on the change in the students' achievement both right after the entrepreneurship course and at the end of the program. The richness of the data-set allowed us to control for many pre-treatment characteristics that may be correlated with both the selection into a specific course and students' achievement. However, in order to further control for self-selection into an English course, we also performed IV-DD estimates, using pre-treatment information on both English proficiency and study-related mobility as instruments. Once we control for selection into the teaching language, estimates showed no significant effects of the teaching mode on student's achievement both in the short and in the long run.

However, further estimates revealed interesting heterogeneity in the estimated effects, being an active style of teaching more effective in the case of females and students from high schools with an academic track. In other words, active entrepreneurship courses seem to benefit mainly those students that should start with relatively low entrepreneurial

propensity (e.g. females) or that were less exposed to experiential/practical teaching during high school (e.g., students from high schools preparing for college).

In sum, our results point out that the effectiveness of the teaching style may be subject-specific and be highly heterogeneous by gender and students background. Furthermore, in the case of entrepreneurship education, if there is any positive effect on students' achievement, such effects are present mainly in the short run, with the exception of females that seem to benefit from innovative teaching methods also in the long run.

From a policy perspective, these findings suggest that universities should invest more in innovative teaching modes based on active students' participation in entrepreneurship education, especially in department/courses traditionally less exposed to management/entrepreneurial skills (such as humanities) and/or with a higher female ratio. Our results are in line with the European Union agenda for entrepreneurship in higher education, which emphasizes the need to adapt entrepreneurship training to different target groups (by level and field of study) and to promote more interactive learning approaches, combining theoretical aspects with practical examples (European Commission, 2008). This is even more crucial since in many entrepreneurship courses female students (and students from "soft" sciences) are under-represented. Hence, targeting students in non-business degrees, such as communication and education ones, might lead to a greater influx of subjects who may potentially benefit more from active teaching styles (Brand et al., 2007).

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Tables

Table 1. Main features of the Italian and the English course of entrepreneurship and “international trade and business” from official syllabus.

Italian course (official English translation)	English course
Panel A – Entrepreneurship bootcamp	
<p><i>Goals:</i></p> <ul style="list-style-type: none"> - To introduce students to the main issues pertaining the entrepreneurial process and the elements of a successful entrepreneurial project. - The students of this course will learn how to recognize and develop a new business idea and how to design the related business model. <p><i>Teaching activities:</i> Lectures, group works, open discussions with professionals</p>	<p><i>Goals:</i></p> <ul style="list-style-type: none"> - The Entrepreneurship bootcamp will push students, day by day, through a pattern for the creation of a new venture out of a raw idea. To join this course students don't need an idea, a pre-existing team, or certainty to succeed. - What we expect from them is their willingness to commit time and energy to their entrepreneurial project, and an open mind. <p><i>Teaching activities:</i> The Entrepreneurship Bootcamp has an innovative design: students meet with the instructors in intensive sessions once a month. Students participate actively individually and in groups to learn “hands-on”</p>
Panel B- International Business	
<p><i>Goals:</i></p> <ul style="list-style-type: none"> - This course focuses on spreading theoretical and practical knowledge on the theory of creating value for the enterprise, on measuring the value and on the evaluation of intangibles. <p><i>Teaching activities:</i> The course is carried out with face-to-face lessons, during which theoretical literature and case studies will be handled.</p>	<p><i>Goals:</i></p> <ul style="list-style-type: none"> - Focus on the acquisition of knowledge, skills, and abilities utilized in the workplace within the international context. - <p><i>Teaching activities:</i> The course is carried out with class lectures, assigned written exercise and discussion of case studies.</p>

Table 2. Sample mean characteristics

	All sample	Italian program - Entrepreneurship	English program - Entrepreneurship	Italian program - Finance	English program - Finance
Students' outcome					
Average grade at the end of 1 year	26.22 (2.00)	25.66 (1.96)	26.45 (1.94)	26.29 (2.01)	26.71 (1.92)
Final mark	103.71 (6.01)	102.50 (5.48)	104.04 (5.80)	103.70 (7.05)	105.02 (5.79)
Students' characteristics					
Female	0.53 (0.50)	0.53 (0.50)	0.51 (0.50)	0.54 (0.50)	0.54 (0.50)
Italian citizen	0.96 (0.20)	0.97 (0.16)	0.97 (0.17)	0.95 (0.21)	0.93 (0.26)
Type of high-school					
Lyceum	0.54 (0.50)	0.53 (0.50)	0.60 (0.49)	0.44 (0.50)	0.61 (0.49)
Years since high school graduation	4.03 (2.03)	4.22 (2.49)	3.98 (1.48)	4.19 (2.43)	3.68 (1.01)
Final Mark at high-school	78.18 (11.28)	77.02 (11.31)	77.34 (10.64)	79.42 (11.49)	79.16 (11.39)
Type of Bachelor degree					
Management	0.62 (0.48)	0.59 (0.49)	0.78 (0.41)	0.46 (0.50)	0.70 (0.46)
Province of residence					
Bergamo	0.82 (0.38)	0.82 (0.39)	0.87 (0.33)	0.78 (0.41)	0.81 (0.39)
Lombardy	0.16 (0.36)	0.17 (0.38)	0.12 (0.32)	0.18 (0.39)	0.15 (0.35)
Italy	0.03 (0.15)	0.01 (0.10)	0.01 (0.09)	0.04 (0.19)	0.04 (0.20)

Note: standard deviation in parenthesis

Table 3. The effect of the teaching style in entrepreneurship education on short- and long-run outcomes, DD estimates

	(1)	(2)	(3)
	DD	DD	FE-DD
Panel A: Short-run outcome			
<i>English*Post</i>	0.513** (0.21)	0.512** (0.21)	0.485** (0.21)
<i>R</i> ²	0.17	0.42	0.48
<i>N</i>	562	562	562
Panel B: Long-run outcome			
<i>English*Post</i>	0.277 (0.80)	0.457 (0.79)	0.540 (0.77)
<i>R</i> ²	0.38	0.59	0.76
<i>N</i>	508	508	508
Personal controls	No	Yes	No
Cohort FE	No	Yes	No
Area FE	No	Yes	No
Bachelor controls	No	Yes	No
High-school controls	No	Yes	No
Student FE	No	No	Yes

Note: Robust standard errors reported in parenthesis are clustered at the student level. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table 4. The effect of the teaching style in entrepreneurship on short- and long-run outcomes, DDD estimates

	(1)	(2)	(3)
	DDD	DDD	FE-DDD
<i>Panel A: Short-run outcome</i>			
<i>English*EE_track*Post</i>	0.365 (0.30)	0.368 (0.31)	0.320 (0.30)
<i>R²</i>	0.17	0.41	0.45
<i>N</i>	1092	1092	1092
<i>Panel B: Long-run outcome</i>			
<i>English*EE_track*Post</i>	0.309 (1.25)	0.074 (1.23)	0.828 (1.17)
<i>R²</i>	0.35	0.56	0.72
<i>N</i>	966	966	966
Personal controls	No	Yes	No
Cohort FE	No	Yes	No
Area FE	No	Yes	No
Bachelor controls	No	Yes	No
High-school controls	No	Yes	No
Student FE	No	No	Yes

Note: Robust standard errors reported in parenthesis are clustered at the student level. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table 5. The effect of the teaching style in entrepreneurship on short- and long-run outcomes by gender, DDD estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	DDD	DDD	FE-DDD	DDD	DDD	FE-DDD
	Female			Male		
<i>Panel A: Short-run outcome</i>						
<i>English*EE_track*Post</i>	0.860** (0.41)	0.870** (0.41)	0.765* (0.40)	-0.230 (0.46)	-0.187 (0.47)	-0.197 (0.46)
<i>R²</i>	0.16	0.41	0.46	0.20	0.42	0.46
<i>N</i>	580	580	580	512	512	512
<i>Panel B: Long-run outcome</i>						
<i>English*EE_track*Post</i>	1.827 (1.55)	1.323 (1.55)	2.814* (1.47)	-1.725 (2.02)	-1.351 (1.98)	-1.587 (1.87)
<i>R²</i>	0.33	0.54	0.73	0.39	0.59	0.73
<i>N</i>	524	524	524	442	442	442
Personal controls	No	Yes	No	No	Yes	No
Cohort FE	No	Yes	No	No	Yes	No
Area FE	No	Yes	No	No	Yes	No
Bachelor controls	No	Yes	No	No	Yes	No
High-school controls	No	Yes	No	No	Yes	No
Student FE	No	No	Yes	No	No	Yes

Note: Robust standard errors reported in parenthesis are clustered at the student level. *** Significant at 1%, ** significant at 5%, * significant at 10%.

Table 6. The effect of the teaching style in entrepreneurship on short- and long-run outcomes by high-school background, DDD estimates

	(1)	(2)	(3)	(4)	(5)	(6)
	DDD	DDD	FE-DDD	DDD	DDD	FE-DDD
	Academic high-school			Technical high-school		
<i>Panel A: Short-run outcome</i>						
<i>English*EE_track*Post</i>	0.859** (0.39)	0.864** (0.39)	0.863** (0.40)	-0.343 (0.47)	-0.338 (0.48)	-0.428 (0.46)
<i>R</i> ²	0.20	0.43	0.48	0.16	0.43	0.43
<i>N</i>	606	606	606	486	486	486
<i>Panel B: Long-run outcome</i>						
<i>English*EE_track*Post</i>	0.812 (1.60)	0.889 (1.59)	1.278 (1.51)	-0.256 (1.99)	-0.458 (1.96)	0.465 (1.87)
<i>R</i> ²	0.40	0.58	0.75	0.30	0.57	0.68
<i>N</i>	536	536	536	430	430	430
Personal controls	No	Yes	No	No	Yes	No
Cohort FE	No	Yes	No	No	Yes	No
Area FE	No	Yes	No	No	Yes	No
Bachelor controls	No	Yes	No	No	Yes	No
High-school controls	No	Yes	No	No	Yes	No
Student FE	No	No	Yes	No	No	Yes

Note: Robust standard errors reported in parenthesis are clustered at the student level. *** Significant at 1%, ** significant at 5%, * significant at 10%..

Table 7. The effect of the teaching style in entrepreneurship education on short- and long-run outcomes, IV-DD estimates

	(1)	(2)	(3)
	IV-DD	IV-DD	IV-DD
<i>Panel A: Short-run outcome</i>			
<i>English*Post</i>	0.050 (1.60)	0.901 (2.79)	0.430 (1.35)
<i>N</i>	552	552	552
<i>Panel B: Long-run outcome</i>			
<i>English*Post</i>	-6.557 (5.04)	-5.079 (8.75)	-5.49 (4.16)
<i>N</i>	508	508	508
Personal controls	Yes	Yes	Yes
Cohort FE	Yes	Yes	Yes
Area FE	Yes	Yes	Yes
Bachelor controls	Yes	Yes	Yes
High-school controls	Yes	Yes	Yes

Note: Robust standard errors are reported in parenthesis. *** Significant at 1%, ** significant at 5%, * significant at 10%. Column (1) relies on the Timing related to the English exam during the Bachelor studies as exclusion restriction, while in Column (2) we introduce the mobility indicator that captures any potential experience abroad in a mobility program offered by University. In Column (3), we use both instruments as exclusion restrictions.

Appendix

Table A1. First stage estimates

	(1)	(2)	(3)
<i>Timing</i>	-0.056** (0.02)	-	-0.055** (0.02)
<i>Mobility</i>	-	0.167*** (0.06)	0.189*** (0.06)
<i>Personal controls</i>	Yes	Yes	Yes
<i>Cohort FE</i>	Yes	Yes	Yes
<i>Areal FE</i>	Yes	Yes	Yes
<i>Bachelor FE</i>	Yes	Yes	Yes
<i>High-school background</i>	Yes	Yes	Yes
<i>N</i>	552	552	552

Note: Robust standard errors are reported in parenthesis. *** Significant at 1%, ** significant at 5%, * significant at 10%. Marginal effects from a linear probability model.