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Succeeding in higher education: effect of an academic support program on first-year university student’s academic achievement

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Abstract

Low success rates in the first year of university remain a major challenge. To improve student success, a Belgian university implemented a targeted academic support program combining a diagnostic test assessing subject-specific skills with remedial courses designed to reinforce these skills. This study aimed to measure the effectiveness of this program, using a propensity score matching method to estimate the causal effect of participation in remedial courses on students’ academic achievement at the end of their first year at university. Based on data from 1,038 first-year students identified as academically at risk through a diagnostic test, the results show that students who regularly attended remedial courses succeeded better than comparable peers who did not participate. The effect increased with the attendance rate, highlighting the importance of sustained engagement in the support program. These findings provide strong evidence that early, targeted academic interventions can improve first-year outcomes among underprepared students in non-selective higher education contexts.

Keywords

Higher education, academic success, support program, program effectiveness, propensity score matching

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Introduction

Over the past decades, higher education has experienced a significant process of democratization. Policies and reforms have made higher education more accessible to a larger part of the population. Therefore, more students from diverse backgrounds access higher education. However, despite these efforts, inequalities persist: some of the students, mostly from disadvantaged backgrounds, still face obstacles and difficulties. While enrolment rates have increased, success rates remain relatively low, with many students struggling to complete their degrees. Especially, the first year in higher education, which is considered as a complex period of academic transition from high school to university (Paivandi, 2015), still has a low success rate. The first-year retention rate is around 70-80% in the United States (National Student Clearinghouse Research Center, 2023), around 90% in United Kingdom (Office for Students, 2022), in France this completion rate is lower than 50% (Ministère de l'Enseignement supérieur et de la Recherche, 2025), and in Belgium it even does not exceed 40% (Leroy et al., 2021). These statistics highlight a common challenge across various countries, whether the higher education system is selective or not : while more students are entering higher education, a significant proportion struggle to successfully complete their first year. Importantly, the countries with a non-selective higher education system are more affected by this issue.

Previous research examined the process of succeeding in higher education, to highlight the factors that facilitate success and enable as many students as possible to succeed. Such studies are numerous, and various factors promoting student success have been identified. For example, student characteristics at the beginning of higher education (e.g. gender, socio-economic and cultural background, knowledge and skills acquired previously) are some of the critical factors involved in academic success (Dupont et al., 2015). However, they explain only a small part of academic achievement and they do not determine students' academic career, so that success remains possible even under unfavourable initial conditions (Altepe et al., 2024). Researchers have also shown that other variables, such as academic environment, are important for academic success. Indeed, the characteristics of the academic environment in which the student evolves (e.g., teaching methods, academic support programs) appear to have a significant impact on students' academic achievement, even if students have disadvantageous characteristics when entering higher education (Dupont et al., 2015). Regarding academic support systems specifically, a positive effect on students' academic achievement was reported (Robbins et al, 2009). The aim of such support systems is to improve students' academic skills and self-management, and to enable students to better integrate into the university environment.

The interaction between students and academic environment, particularly through orientation and support to students by the institution, as well as the academic and social integration of students into the new environment, is essential for the student's progress (Tinto, 1975; 1987). It seems that the most effective way for an institution to help students succeed is to improve their skills level (Dupont et al., 2015). More precisely, researchers suggest to implement academic support system to assess students’ skills level - considered as prerequisites for their major - at the beginning of higher education, to identify their gaps and difficulties and to offer support such as remedial courses (e.g. Bettinger, 2013; Hublet et al., 2021; Romainville, 2000).

Implementing academic support systems in higher education therefore seems to be essential for the student's academic career. To this end, governments have adopted policies to promote student success, leading higher education institutions to implement support programs designed to help students identified as being academically at risk (Bowman et al., 2023). The implementation of these support systems raised questions about their effectiveness, at the level of the institutions seeking to improve them, and at the level of the governments funding these support systems. Qualitative studies highlighted the effectiveness of some academic support systems, by measuring student satisfaction in participating in academic support programs and its effect on their academic success (e.g. Wathelet & Vieillevoye, 2013). However, quantitative studies on this issue remains scarce. Especially studies testing a causal relationship between the participation to an academic support program and the academic achievement are lacking. Testing causal inference means studying the impact of a treatment on an outcome (Cunningham, 2021), and to this end, an often-used method is to compare the results of two groups of participants, one participating in the treatment and the other not participating in the treatment, while controlling for the possible effect of other variables to ensure that the difference observed is due to the treatment. Regarding academic support programs, measuring their effectiveness is a complex task because of non-random assignment and selection bias of participants, leading to methodological and statistical issues in assessing the impact of these programs. However, advanced statistical methods are available to overcome these issues. Recent studies, using adapted statistical methods, proposed some results on the effectiveness of academic support programs. For example, Guarcello et al. (2017) reported a significative causal relationship between participating in an academic support program and students’ academic achievement, by using the propensity score matching method. Similarly, Bowman et al. (2023) highlighted, through propensity score analyses, that participating in an academic support program during the year led to better end-of-year academic results for the first-year students. While these preliminary findings are promising, further studies using advanced statistical methods are needed to obtain reliable results and to extend these findings to various support programs. Indeed, the first studies investigated a specific academic support program, the supplemental instruction (SI), which is a peer-led support program offering voluntary sessions to help students succeed in challenging courses (Bowman et al., 2023; Guarcello et al., 2017). To our knowledge, this statistical analysis method has not been used to measure the effectiveness of academic support programs aiming to reinforce students' subject-specific prerequisite level. Extending the investigation to such remedial programs would be interesting.

Moreover, most existing quantitative studies are related to academic support systems from countries with selective and/or fee-based admission system (e.g. United States). However, other countries have adopted open access (non-selective) higher education systems. In Belgium for example, there is no entrance exam (except for engineering, medical and art schools) and admission fees are low (Massart & Romainville, 2019). The objective is to enable every student to enrol in higher education, ensuring equal opportunity. All students with high school diploma can be admitted at the university, regardless of their previous educational career (e.g. students' skill level, high schools' academic level…). Due to inequalities in the Belgian secondary education system (OECD, 2023), there can be a gap between what students should know and what they actually know when finishing high school, and teachers have no indication of their students' skill levels at the start of the first year at university, which prevents them from properly tailoring their courses to students' needs. This may explain why the completion rate at the end of the first year is very low. In this context, a Belgian university implemented an academic support program focused on major prerequisites, to help students succeed better in their first year at university. The aim of this program is to assess students' skills level trough a diagnostic test at the beginning of higher education, to identify students with gaps and difficulties (considered as students academically at risk), and to offer them support options adapted to their needs.

Present study

Despite the implementation of academic support systems in higher education institutions, there is a significant lack of research on their effectiveness. In particular, quantitative studies examining causal relationships between student participation in these programs and academic success are limited. Most existing studies rely on qualitative or correlational analyses, making it difficult to determine whether these support systems directly contribute to improve student outcomes. Furthermore, studies assessing these programs are often concentrated in selective higher education systems, while there is little information on non-selective higher education models. This gap in the literature limits the understanding of academic support programs across different higher education systems and of their impact on student academic success.

The present study is based on an academic support program of a non-selective Belgian university and focused on the effectiveness of a support system on the first-year university students' academic achievement. In this article, we were interested in the effect of the participation in remedial courses, designed to reinforce subject-specific skills during the first year at university, on students' academic success at the end of their first year. We studied the causal relationship between these variables using the propensity score matching method.

Method

Sample

A group of 1834 students took the subject-specific test offered as a part of the academic support program, which represents around 65% of the students enrolled for the first time as undergraduates during the 2021-2022, 2022-2023 and 2023-2024 academic years in various majors (economics, pharmaceuticals, biology, physics, bioengineering, computer science, and mathematics) at our university. In order to control the previous school career of the participants, we focused exclusively on the Belgian high school graduates. Among these students, 1038 students were identified as academically at risk based on their test scores and were contacted by the academic advisors for a meeting to discuss about their academic situation. Among the students who agreed to the meeting, 160 accepted the support offers and enrolled in remedial courses. The treatment group refers to the 160 students who enrolled the remedial courses. The control group includes the 878 "at-risk" students who did not accept the meeting and/or the support offers.

The students could be grouped according to various factors. The students were from various nationalities and were grouped into Belgian vs. non-Belgian. Students came from various socio-economic backgrounds and were grouped into three subgroups according to the socio-economic status (SES)[1] of their high school: students from high schools with very low SES (≤5), students from high schools with medium SES (>5 and ≤17) and students from high schools with high SES (≥18). Participants were also grouped according to whether or not they receive a scholarship for their higher education studies. In addition, the sample included students graduated from general, technical, artistic or vocational secondary education, leading to two subgroups: general vs. technical, artistic or vocational education. Finally, students were grouped according to whether or not they had repeated at least a year during their previous school career. The characteristics of the sample are presented in Table 1.

Table 1. Sample characteristics

	Control group		Treatment group	
	n	**%**	**n**	**%**
Total	878	100	160	100%
Gender				
Male	513	58%	69	43%
Female	365	42%	91	57%
Nationality				
Belgian	732	83%	126	79%
Non-Belgian	146	17%	34	21%
SES				
Low	245	28%	56	35%
Medium	476	54%	83	52%
High	157	18%	21	13%
Grade repetition (previous school career)				
No repetition	638	73%	100	62%
Repetition	240	27%	60	38%
Education type (high school)				
General	751	86%	121	76%
Technical/Artistic/Vocational	127	14%	39	24%
Scholarship status (university)				
No scholarship	544	62%	69	43%
Scholarship	334	38%	91	57%

Materials

Data on students' subject-specific skills level were collected using a diagnostic test. Although other tests assessing literacy, methodological and digital skills were administered, only the

[1] The socio-economic status of a school is calculated based on seven variables characterizing the households of the students attending the school site, the school or the statistical sector: income, diploma levels, professional activities, unemployment rate, activity rate and rate of social assistance recipients. A low value indicates a lower socio-economic level.

subject-specific skills test was considered in the present study, given that previous studies showed that it is by far the strongest success factor, and it is significant even when the effect of other skills level is controlled (e.g. Altepe et al., 2024). Depending on the requirements of each curriculum, the subject-specific skills test included one to four parts. Each part assesses skills related to a specific subject: mathematics, physics, chemistry and biology. The content of each part of the test was defined according to the requirements and specificities of each curriculum. The skills, considered as prerequisites for the major, were identified by university professors, university students and high school teachers and the test was constructed by university professors and teaching assistants and validated by high school teachers. The test included closed multiple-choice questions, multiple-response questions and open-ended questions. The subject-specific skills level, which is an average score out of 20 points calculated based on the scores obtained in each part of the subject-specific skills test, is one of the controlled independent variables (as well as the gender, the nationality, the socio-economic status and the previous school career) in this study.

Data on students' participation in the remedial courses were collected by academic advisors during the year. The students were monitored by academic advisors throughout the year and a follow-up file for each student was completed by the advisor as the year progressed. Follow-up data such as the type and the number of remedial courses taken by each student, the participation rate of each student in remedial courses, etc. were collected. The participation rate in the remedial courses, calculated based on the number of class hours attended by student out of the total number of class hours, is the main independent variable in this study. For students enrolled in multiple remedial courses, the highest participation rate was considered to avoid losing information about student engagement by averaging the different participation rates.

Data on students' exam results were collected at the end of each exam session. Academic achievement, measured by the results obtained at the end of the first year at university, and more precisely by the percentage of credits acquired, is the dependent variable (outcome). Since some students reduced their course load (representing 6% of the sample), the percentage of credits earned has been used for the analysis. This percentage is calculated based on the number of credits acquired at the end of the first year and the number of credits included in the student's first year course load.

Procedure

Data were collected as part of the academic support program of our university, during three academic years (2021-22, 2022-23 and 2023-24). This support program consists in two main steps to help students succeed better in their first year at university.

The first step involves the implementation of a non-compulsory and non-binding diagnostic test at the beginning of higher education. To this end, a test assessing various skills (subject-specific, literacy, methodological and digital), considered as prerequisites for their major, was offered to students at the beginning of the academical year, during the first weeks. Most students took the test on site (95%). An online version of the test was offered to students who were unable to take the test in person for various reasons (e.g., late admission at university, absence for medical reasons, lack of information). Depending on the number of parts included in the test, the time allowed to complete the test fluctuated between 45 minutes and 3 hours, in one single session or spread in several sessions.

In the second step, an academic support was offered based on the test results and adapted to the students' needs. The academic advisor informed individually each student about the test results by email. If the score was low, the students were identified as academically "at risk", they were informed about their test results and they were invited to meet the academic advisor. Students who accepted the meeting were informed more precisely about their test results, gaps and difficulties. Then, the advisors offered them support options adapted to their needs. These options included the reduction of the course load, remedial courses to reinforce subject-specific, literacy, methodological and digital skills and advice about higher education career reorientation. The students were informed that they were not obliged to accept the support offers.

Here, we focused on one type of support: the subject specific remedial courses. The aim was to reinforce subject-specific skills considered as prerequisites for the major of the students. Depending on the students' major and needs, there were remedial courses for different subjects: math, physics, chemistry and biology. Students could take one to four subjects, depending on their major and their needs. The academic advisors guided them to make the best choice based on their diagnostic test results and the requirements of their faculty. From a practical point of view, the remedial courses were held over several sessions, starting at the beginning of the academic year and lasting several weeks throughout the first semester, or even throughout the two semesters. The classes were taught by teaching assistants and/or high school teachers, since the targeted skills were supposed to be acquired before entering higher education and were therefore high school level subjects. Each class was 2 to 4 hour long. The remedial course timetable was adapted to the students' course schedules, and the classes were held out of regular course hours, on weekdays during the day or evening, or on Saturday mornings. The classes were held on the campus. The students were monitored by academic advisors throughout the year and a follow-up file for each student was completed by the advisor as the year progressed. Follow-up data (e.g., type and the number of remedial courses taken by each student, rate of participation of each student in remedial courses) were collected.

The socio-demographic data (e.g., age, gender), the previous school career data (e.g., repeating a year during primary/secondary school) and the current academic career data (e.g., enrolment, reduction in course load, exam results) were collected from the administrative databases of the university. Data on exam results were collected at the end of each exam session.

The research was approved by the relevant institutional ethics committee. Students were informed that their anonymized administrative data could be used for research purposes. Data were processed anonymously, in compliance with the General Data Protection Regulation, and analysed using RStudio software (RStudio Team, 2022).

Results

Subject-specific skills level when entering higher education and academic achievement at the end of the first year at the university

Figure 1 compares subject-specific skill levels at the beginning of higher education between the control and treatment groups and it shows a slightly higher skill level in the control group. The difference in medians observed between the two groups is significant ($U = 54672.00$; $p < .001$). Overall, the subject-specific skills level is low in both groups. Students do not seem to have the basic skills required for their major.

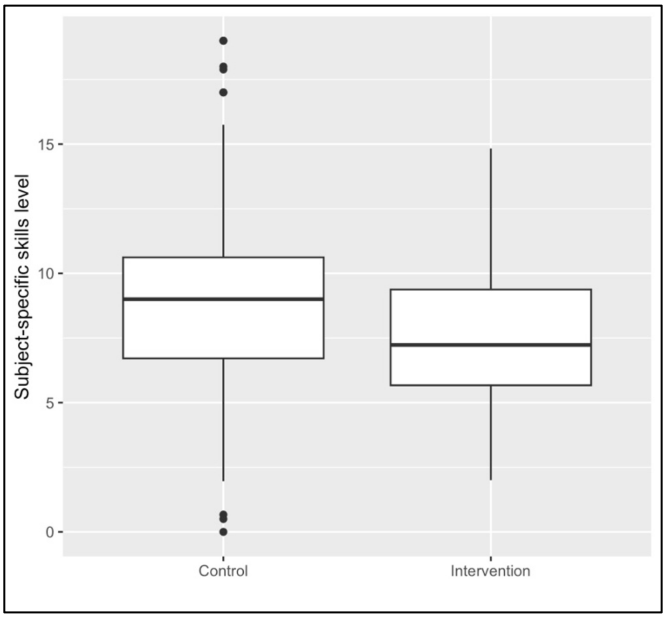

Figure 1. Subject-specific skills level at the beginning of higher education (score out of 20)

Figure 2 illustrates the percentage of credits earned at the end of the first year by students in the control and treatment groups, revealing a slight difference in outcomes. The difference in medians observed between the two groups is not significant ($U = 60050.50$; $p > .05$). Overall, both groups have earned a low percentage of credits at the end of the first year.

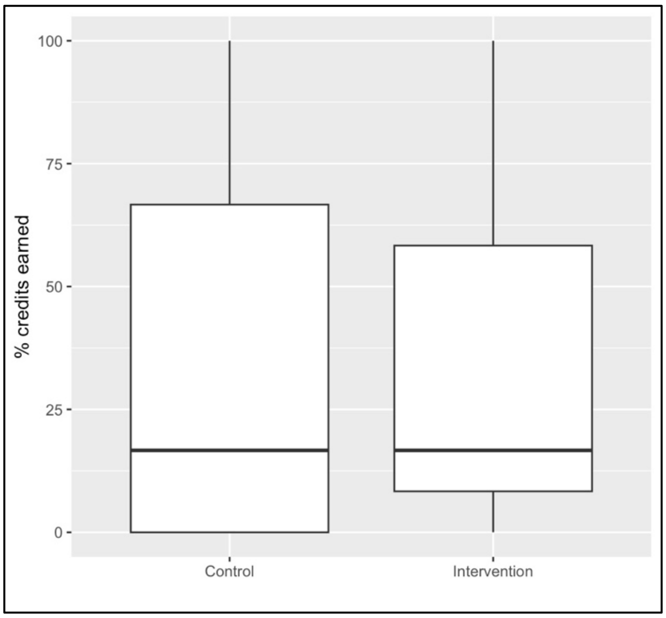

Figure 2. Percentage of credits earned at the end of the first year

Both groups were analysed across various demographic categories, including gender, nationality, socioeconomic status (SES), grade repetition, education type, and scholarship status. Table 2 shows that the Belgian students, the students from higher socio-economic backgrounds, the students who have never repeated a year during previous school career and the students with a general secondary education seem to arrive slightly better prepared for university and succeed better at the end of the year. It also appears that female students arrive at university less well prepared, yet succeed better at the end of the year than male students. These observations apply for both control and treatment groups.

Table 2. Subject-specific skill level at the beginning of higher education and academic results at the end of the first year

	Control group (n = 878)						Treatment group (n = 160)					
	Subject-specific skill level			Academic results			Subject-specific skill level			Academic results		
	M	Md	ET	M	Md	ET	M	Md	ET	M	Md	ET
Total	8.64	9.00	2.79	36.24	16.67	37.13	7.60	7.23	2.64	35.48	16.67	36.69
Gender												
Male	8.81	9.00	2.70	31.95	16.67	35.73	8.06	8.00	2.65	29.58	11.11	37.08
Female	8.41	8.38	2.90	42.28	25.00	38.25	7.25	7.00	2.59	39.95	30.00	35.94
Nationality												
Belgian	8.71	9.00	2.72	38.38	25.00	37.69	7.69	7.50	2.70	36.92	16.67	37.95
Non-Belgian	8.28	8.00	3.08	25.54	8.33	32.22	7.25	7.00	2.41	30.15	16.67	31.81
SES												
Low	7.78	7.84	2.93	27.54	8.33	34.02	7.51	7.00	2.94	29.66	16.67	34.58
Medium	8.84	9.00	2.62	37.98	25.00	37.64	7.53	7.50	2.46	38.10	25.00	38.50
High	9.39	9.20	2.75	44.54	33.33	37.83	8.12	8.00	2.54	40.66	40.00	34.43
Grade repetition (previous school career)												
No repetition	8.88	9.00	2.82	40.28	25.00	37.73	7.97	7.62	2.75	44.73	33.33	38.39
Repetition	8.00	8.00	2.61	25.50	8.33	33.25	6.99	7.00	2.34	20.07	9.09	27.72
Education type (high school)												
General	8.84	9.00	2.82	39.81	25.00	37.80	8.13	8.00	2.59	41.45	25.00	38.16
Technical/Artistic/Vocational	7.47	7.55	2.24	15.16	0.00	23.84	5.97	6.00	2.07	16.96	8.33	23.81
Scholarship (university)												
No scholarship	9.09	9.00	2.74	39.02	25.00	38.22	7.77	7.67	2.56	38.49	25.00	37.31
Scholarship	7.91	8.00	2.72	31.72	16.67	34.86	7.47	7.00	2.70	33.20	16.67	36.25

Participation to the remedial courses and academic achievement at the end of the first year at university (control vs. treatment group)

Studying the effect of an academic support program on students' academic achievement is a complex task due to non-random assignment and selection bias. In an ideal situation, students would be randomly assigned to either the treatment group or the control group. This way, the other observed variables affecting the outcome (e.g. students' entry characteristics) would be controlled, and the researchers could conclude that the observed difference in academic results is due to the treatment and not to the other variables. In a real-life situation, it is not possible to randomly assign students to the treatment group or to the control group. In most cases, students choose to participate or not in the academic support program. It may be therefore not possible to control the effect of other observed variables on the outcome nor to ensure that the difference observed between the two groups is due to the treatment or to other variables. However, advanced statistical methods are available to overcome these issues. Here, we chose the propensity score matching to tackle this issue because it makes it possible to reduce the effects of bias due to the non-random assignment of the participant in the compared groups (Deb et al., 2016). The propensity score is the probability (from 0 to 1) that a participant is assigned to the treatment group according to the observed covariates (e.g. demographic characteristics, etc.) (Rosenbaum & Ruben, 1983). The propensity score matching is one of the most common methods using the propensity score. In this method, participants with similar propensity scores in the treatment and control groups are matched. The two groups, including participants with similar characteristics, are then compared.

To measure the effect of the participation in remedial courses on students' academic achievement, the optimal full matching method was used. This method assigns each treated and control student to a matched group (subclass) containing one treated unit and one or more control units, or one control unit and one or more treated units. It is optimal because it minimizes the distances between matched students, improving the comparability of groups. In this approach, the distance between units was calculated using propensity scores estimated from a generalized linear model (GLM) with a logit link function, which models the probability of receiving treatment based on observed variables. The method targets the average treatment effect on the treated (ATT), meaning the effect is estimated specifically for students who actually participated in the remedial sessions. After matching, the weights based on subclass membership (functioning like propensity score weights) are used to estimate a weighted treatment effect, reducing bias from observed variables. In this analysis, students who attended remediation sessions were compared to similar peers—matched on characteristics such as gender, nationality, socio-economic status, prior school history, subject-specific skills at entry, and academic progress—who did not attend. This method allowed for a more accurate estimation of the impact of remedial courses on academic success, while controlling for other observed variables.

Figure 3 shows the propensity score distributions before and after matching. Before the matching (left panel, *Unadjusted Sample*), the propensity score distributions differ between the control and treatment groups, indicating a lack of balance. The left panel show also a substantial overlap between the two distributions. This overlap region ensures that for a significant proportion of treated units there are control units with comparable propensity scores, allowing the matching. This comparability between treated and control units within the overlap region is crucial for reducing selection bias and enabling a more accurate estimation of the treatment effect. After the matching (right panel, *Adjusted Sample*), the distributions appear highly similar, suggesting an improved balance between the two groups. This overlap confirms that the matching procedure effectively reduced selection bias based on observed variables and created a sample in which treated and control units are comparable in terms of their estimated propensity scores.

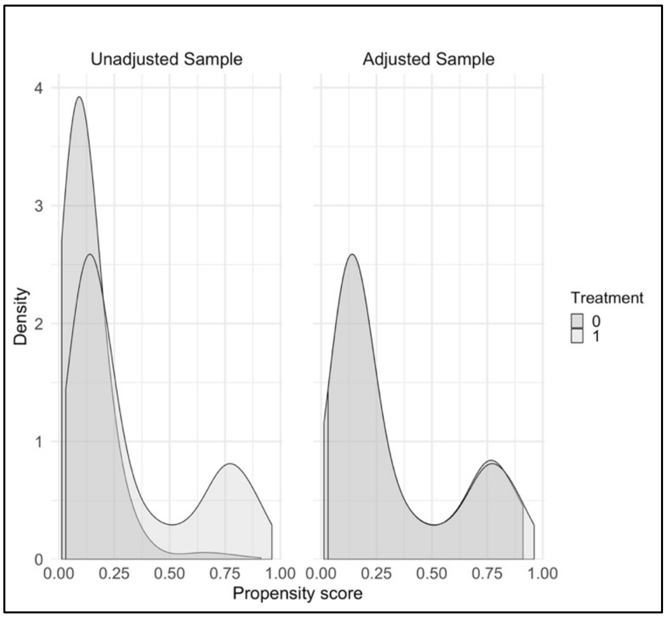

Figure 3. Propensity score distribution before and after matching

The matching analysis highlighted that enrolling and attending in remedial courses allows to succeed better at the end of the year. More precisely, Figure 4 shows that the more the students take part in remedial sessions during the academic semesters, the better they succeed at the end of the year. The difference between the two groups is significant at all levels of participation in remedial courses. A regular participation in remedial courses seems to help to improve academic results. For example, participating in more than 90% of the remediation sessions enables students to acquire on average over 20% credits more than the students who have not enrolled in remediation. This is equivalent to at least 12 additional credits in a 60-credits program.

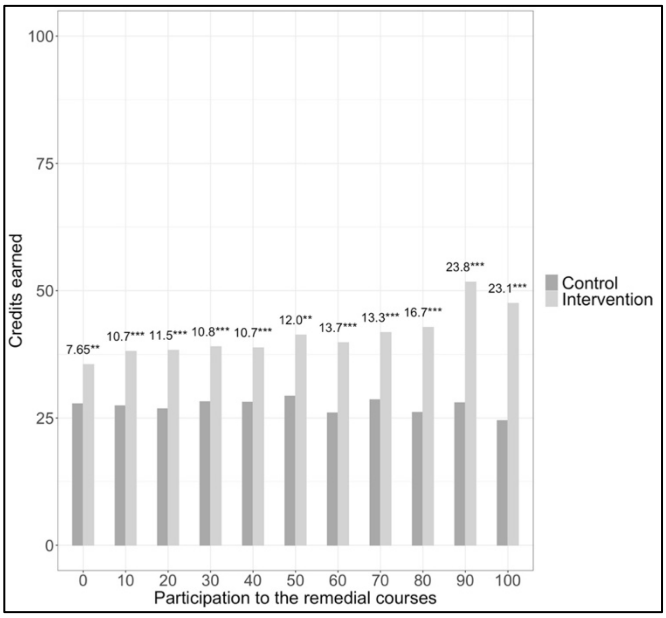

Figure 4. Percentage of credits earned by participation to the remedial courses (control vs. treatment)

These results are stable even when various matching methods (nearest neighbor matching, subclassification) are used to perform the analyses. Nearest neighbor matching and subclassification are two other methods commonly used in causal inference. Nearest neighbor matching pairs each treated unit with the control unit that has the closest propensity score. Subclassification, on the other hand, divides the sample into several strata (or subclasses) based on the distribution of propensity scores and compares treated and control units within each stratum. In both approaches, propensity scores were estimated using a generalized linear model (GLM) with a logit link function, modelling the probability of treatment assignment from observed variables. The estimand was set to ATT, focusing the analysis on the effect of the treatment for those who actually received it. Both methods aim to reduce bias due to observed variables and provide more reliable estimates of treatment effects. However, the result seems less stable and often not statistically significant with Nearest neighbor matching, likely due to the one-to-one matching, which leads to smaller matched samples, less precise balance and reduced statistical power. Table 3 allows us to say with greater confidence that participating in remedial courses during the first year at university improve academic success, since the findings are consistent regardless the method used. The more the students attend the remedial courses, the better they succeed during their first year at university.

Table 3. Percentage of credits earned by participation to the remedial courses (control vs. treatment) using various matching method

Attendance rate to the remedial courses	**Reference (Full)**	**Method A (Nearest)**	**Method B (Subclass)**
	Mean difference[a]	Mean difference	Mean difference
0% (n^t=160)[b]	7.65** (n^c=878)[c]	8.09* (n^c=160)	7.77** (n^c=878)
10% (n^t=131)	10.7*** (n^c=878)	4.99 (n^c=131)	8.73** (n^c=878)
20% (n^t=126)	11.5*** (n^c=878)	5.96 (n^c=126)	10.5*** (n^c=878)
30% (n^t=114)	10.8*** (n^c=878)	5.38 (n^c=114)	7.21* (n^c=878)
40% (n^t=108)	10.7*** (n^c=878)	6.41 (n^c=108)	8.13* (n^c=878)
50% (n^t=100)	12.0*** (n^c=878)	10.0 (n^c=100)	11.0** (n^c=878)
60% (n^t=85)	13.7*** (n^c=878)	12.5* (n^c=85)	12.9*** (n^c=878)
70% (n^t=72)	13.3*** (n^c=878)	6.5 (n^c=72)	13.0*** (n^c=878)
80% (n^t=40)	16.7*** (n^c=878)	10.9 (n^c=40)	17.5*** (n^c=878)
90% (n^t=25)	23.8*** (n^c=878)	35.2** (n^c=25)	25.6*** (n^c=878)
100% (n^t=23)	23.1*** (n^c=878)	26.6* (n^c=23)	21.6** (n^c=878)

Note: [a]Mean difference of percentage of credits earned (control vs. treatment group); [b]n^t = treated sample; [c]n^c = control sample.

Discussion

The present study investigated the effectiveness of an academic support program on first-year university students' academic achievement within a non-selective higher education context. More precisely, we were interested in the impact of the participation in remedial courses, designed to reinforce subject-specific skills during the first year at university, on students' academic success at the end of their first year. Using the propensity score matching method, we studied the causal relationship between these variables, controlling the effect of other variables related to students' socio-demographic characteristics, previous school career, academic career and subject-specific skills level at the beginning of higher education. The findings provide evidence supporting the positive effect of students' participation in remedial courses on their first-year academic achievement. Such results align with previous studies that identified a causal relationship between some academic support programs and academic achievement (e.g. Bowman et al., 2023; Guarcello et al., 2017), extending the evidence to non-selective higher education systems as the Belgian university context.

Overall, the results showed that students who regularly attended the remedial courses earned significantly more credits at the end of the first year than those who did not, even when matched on socio-demographic and academic variables. Importantly, the effectiveness of the remedial courses increased with the attending rate: the more the students attended the remedial course sessions, the better they succeeded at the end of the first year. The results suggest that a regular attendance and a steady involvement in an academic support program matters for outcomes. These findings are consistent with Batzer (1997), who demonstrated that students who completed remediation succeed better than those who completed some or none of the remediation, reinforcing the idea that student involvement in support program significantly influences academic outcomes.

Interestingly, the descriptive analyses initially revealed a slight, but statistically non-significant, difference in academic performance in favour of the control group. However, these results must be interpreted in light of the fact that students in the treatment group had a significantly lower level of subject-specific prerequisite skills, as measured by the diagnostic test. This suggests that they entered university with a lower level of academic preparation, which is known to be associated with increased risk of academic difficulties (Tinto, 1987; 1993). When background and academic variables were statistically controlled using propensity score matching, the results revealed a reversed trend: students in the treatment group—particularly those who regularly attended the remedial sessions—achieved significantly better academic results than their matched peers in the control group. These findings highlight the importance of controlling for initial group differences when evaluating the effects of an academic support program and demonstrate the effectiveness of targeted remedial interventions for students with lower academic preparation. This supports previous research showing the role of support programs in reducing academic gaps and difficulties and promoting equity in student academic achievement (Bowman et al., 2023; Guarcello et al., 2017).

An intriguing result is the difference observed between the students of the control group and the students of the treatment group who were enrolled in remedial courses but did not attend any sessions (Figure 4, 0% of attendance). Surprisingly, despite their non-participation in these sessions, these students still outperformed their matched peers in the control group. This may reflect the indirect benefits of simply being involved in the support program. The diagnostic test, the meeting with an academic advisor, and the feedback received during this meeting may have increased their awareness of their academic challenges and encouraged them to adopt their own strategies to overcome their gaps and difficulties. For example, they might have adopted better time management or study strategies independently, motivated by the program's initial guidance and the psychological effect of being “targeted” for support. It is also important to highlight the role of the feedback in this context. Indeed, studies have shown that well-designed feedback—timely, specific, and constructive—significantly enhances students’ motivation, engagement, and academic achievement (e.g. Evans, 2013; Nicol & Macfarlane-Dick, 2006). Feedback provides students with clear information about their academic situation, which can foster their self-awareness and drive them to adopt more effective strategies to succeed better. This finding is consistent with previous research showing that academic support and self-assessment opportunities, even without full participation, can enhance motivation, self-regulation, and engagement (Howard et al., 2021; Robbins et al., 2009; Tinto, 1987). Future studies should explore the psychological effects of engagement in support programs, even when participation remains limited.

The data also confirm well-established academic success factors such as socio-demographic characteristics, socio-economic background, previous school career and subject-specific skills level when entering higher education. The positive effect of the participation to the remedial courses was observed at the overall group level. However, it would be relevant to explore whether this effect varies across specific subgroups of students with different characteristics, for example, comparing students with low versus high socio-economic backgrounds. Further research needs to investigate the impact of the academic support program in each sub-group, which necessitates larger and more representative samples within each subgroup than in the present study.

As a final comment, it is worth mentioning that despite the use of the propensity score matching method, which enables to control the observed variables to estimate the effectiveness of the intervention on the outcome in order to reduce the non-random assignment problems, there are still unobservable variables that are not taken into account in the analysis. For example, motivation and engagement in higher education, which are considered as important factors in academic success (e.g. Howard et al., 2021; Richardson et al., 2012; Robbins et al., 2004), are not included in the analysis due to lack of data. The findings provide reliable evidence about the effectiveness of the intervention, further research could explore how these motivational dimensions interact with support programs and influence academic outcomes. Moreover, the study focused on academic achievement at the end of the first year and long-term effects such as retention and graduation rates were not taken into account here. Future research needs to explore these longitudinal outcomes and include qualitative data to better understand student experiences and motivation for engagement in support programs.

Conclusion

This study provides strong evidence that the regular participation in an academic support program improves significantly academic achievement among first-year university students, particularly in a non-selective higher education context. The results point out the effectiveness of an academic intervention in supporting students identified as underprepared based on a diagnostic assessment at the beginning of higher education. The observed positive effects highlight the importance of integrating academic support systems into institutional policy. Given the persistent challenges of low success rates in the first year of university, particularly in non-selective systems, these findings support a wider implementation of academic support programs. Policymakers and university administrators should consider these interventions as essential to promote equity and increase student success in higher education.

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