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Gerard J.A. Baars

Netherlands Initiative for Education Research, the Hague, the Netherlands, g.baars@nwo.nl

Henk G. Schmidt

Erasmus School of Social and Behavioural Sciences, Erasmus University Rotterdam, Rotterdam, the Netherlands

Peter Hermus

Risbo, Erasmus University Rotterdam, Rotterdam, the Netherlands

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Early Identification of Successful and Unsuccessful Students in the First Year at the University

Gerard J.A. Baars^{a,*}, Henk G. Schmidt^b, Peter Hermus^c

^a Netherlands Initiative for Education Research, The Hague, the Netherlands

^b Erasmus School of Social and Behavioural Sciences, Erasmus University Rotterdam, Rotterdam, the Netherlands

^c Risbo, Erasmus University Rotterdam, Rotterdam, the Netherlands

Abstract

Purpose: To investigate how well at an early stage, based on pre- and post-enrolment data, students could be identified who become successful and unsuccessful in the first year at the university.

Method: Based on pre- and post-enrolment data, 24,976 students of the cohorts 2009–2015 were divided in subgroups. For each subgroup the percentage of successful, delayed, and unsuccessful students at the end of the first year was determined.

Results: Based on only the pre-enrolment data, i.e. sex, ethnic background, and type and level of achievement during the final examinations of pre-university education, on the one hand subgroups of students with a 74–82% success rate and a 5–10% dropout rate could be identified. On the other hand, subgroups with only a $\leq 35\%$ success rate and an almost 50% dropout rate. By adding post-enrolment data, i.e. the achievement of students at the first two exams in the university, subgroups with a $\geq 90\%$ success rate and a $\leq 5\%$ dropout rate could be identified, and subgroups with only a $\leq 10\%$ success rate and a $\geq 70\%$ dropout rate.

Discussion: It is possible to identify successful and unsuccessful students at a very early stage. The challenge for the future is to investigate what appropriate interventions can be developed for (a) students who already before the start of their academic career or very early after the start at the university have a high chance of becoming unsuccessful and for (b) those who have a high chance of becoming successful.

Keywords: Student success, Dropout, Sex, Pre-admission GPA, Ethnic background

1. Introduction

Worldwide, much attention is paid to student success in higher education. This attention is understandable from the fact that many students suffer from study delays, i.e. taking longer to study than the nominal duration, or even drop out [1–4]. For example, in 2017 the US Department of Education reported that only 34% of the students completed their program within the normal duration. After six years this percentage was still only 61% [2]. Similar percentages can be found in other parts of the world. For example, in South Africa only 16% of the students of cohort 2011 completed their

three-year qualifications within the minimum time. After 6 years of study, this percentage was 64% [5].

These low percentages are a problem for students, because study delay could in the end lead to dropping out [6–8]. Moreover, study delay or - even worse - dropping out could cost money, especially in countries where students need to take out a loan for their studies. And, finally, a non-optimal study career could put students at a disadvantage in the labor market. Therefore, for students it is very relevant to know as soon as possible in which study domain and at what academic level their chances for study success are the highest. In addition, study delays present a problem for institutions of higher education, because these need to make an extra

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* Corresponding author. Netherlands Initiative for Education Research, Laan van Nieuw Oost Indië 300, 2593 CE, The Hague (Java Building), the Netherlands.
E-mail address: g.baars@nwo.nl (G.J.A. Baars).

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teaching effort to let delaying students graduate. Moreover, institutions of higher education have an interest in not spending scarce resources on students who will not be able to complete their studies at all.

It is known that many students who are not successful in university (i.e. suffer from study delay or even drop out) already perform less well in the first academic year [1,9–12]. If at a very early stage, preferably before students enroll at the university or, if that is not possible, very early in the first academic year, students could be identified who will become successful in the first year and those who will not, this would open up avenues for remediation or early referral.

But the question is whether it is possible to identify students who will be successful and those who will be not successful at the university already before they enrol or very soon after enrolment at the university. What would be predictive factors? Based on literature, it is known that the students' sex possibly plays a role in predicting study success. More specifically, research suggests that women outperform men at the university [13–17], although some other studies do not confirm this [18–20]. Another predicting factor seems students' ethnic background [13,17,21,22]. This literature suggests that majority students outperform minority students in university. And a third and maybe most promising predicting factor before student enrol at the university, is the level at which they performed during pre-university education [17,23,24]. It seems that the higher the level of performance during pre-university education, the better students perform at the university.

The first research question of this study was therefore how well successful and unsuccessful students in the first year at the university could be identified based on (the combination of) their sex, ethnic background and type and level of achievement during pre-university education.

Literature suggests (but has not yet shown) that early after the start in the university the identification of students who will be successful at the end of the first year and those who will be unsuccessful would probably improve. The most promising predictive factor early *after* enrolment seems students' performance on the first exams at the university. Earlier studies have demonstrated that there is a

relationship between these early results and subsequent performance [11,25–28]. Students who do not pass the first exams have a poorer perspective of being successful than students who pass these exams.

The second research question of this study was therefore how well successful and unsuccessful students in the first year could be identified based on students' performance at the first exams in the university, also in combination with their pre-enrolment data.

2. Method

2.1. Overview

This study was conducted at a medium-size university in the Netherlands. First-time students in the bachelor programs in the field of Business Administration, Public Administration, Medicine, Health Policy and Management, Economics, Law, Criminology, Psychology, Sociology, History, Cultural Studies, Communication and Media, and Philosophy were included. First-year success in the Netherlands is strongly influenced by the so-called Binding Study Advice (BSA). This regulation implies that students need to have obtained a minimum number of ECTS¹ credits at the end of the first year in order to be able to continue their studies. Students who are not successful receive a negative BSA, which means that they are not allowed to reregister for the specific program in the next 3 years. The only exemption is made for students who have suffered from adverse personal circumstances, such as serious illness or the death of a close relative. These students are still allowed to continue their studies.

2.2. Participants

In this study, 24,976 full-time students who enrolled in the bachelor programs between 2009 and 2015 were included. Of these students, all the necessary pre- and post-enrolment data were available as well as data on their performance at the end of the first year.

2.3. Materials

Table 1 presents an overview of the pre- and post-enrolment data included in this study.

¹ European Credit Transfer and Accumulation System (ECTS) is a standard means for comparing academic credits for higher education institutes across collaborating European countries. One academic year corresponds to 60 ECTS credits that are equivalent to $60 * 28 \text{ h} = 1680 \text{ h}$ of workload. ECTS credits are only awarded upon successful completion of a curriculum component.

² GPA obtained during the final examinations. This GPA consisted of 50% national exam and 50% school exam. Value between 5.5 (sufficient) and 10 (excellent).

Table 1. Overview of the variables included in this study.

Variable	Definition	Source
Enrolment of students (cohorts 2009–2015)	Full-time student, first-time registration for a specific program, and registration before the first of October in a specific year.	Central administration system of the particular university.
Sex	1 = Men 2 = Women	Education research database of the particular university.
Ethnic background of students	1 = Majority: Students who were born in the Netherlands and whose parents were also born in the Netherlands. 2 = Western minority: Students with a migration background in Europe (with the exception of Turkey), North America, Oceania, Indonesia or Japan. 3 = Non-western minority: Students with a migration background, but in other countries than the western minority students.	Self-reported data, obtained from the education research database of the particular university.
Type and level of achievement during the final examinations of pre-university education	1 = Students with a Dutch pre-university education GPA (in Dutch: “VWO”) between 5.5 and 6.4 ² . 2 = Students with a Dutch pre-university education GPA between 6.5 and 7.4. 3 = Students with a Dutch pre-university education GPA of 7.5 or higher. 4 = Students who enrolled at the university with a certificate of successful completion of the first year of Dutch higher professional education (in Dutch: “hbo”); 5 = Students who had followed and completed their pre-university education abroad (outside the Netherlands).	Central administration system of the particular university.
Achievement at first two exams in the university (obtained within the first three months in the first academic year)	1 = 0 out of the first 2 exams completed successfully (successful: “a grade equal to or higher than 5.5”). 2 = 1 out of 2 exams completed successfully. 3 = 2 out of 2 exams completed successfully.	Central administration system of the particular university.
Study success in the first year	1 = Successful completion of the first year: at the end of the first year these students had obtained all 60 ECTS credits belonging to the first-year program. 2 = Study delay: (a) students who had passed the BSA-criterion but had not obtained all 60 ECTS credits belonging to the first-year program at the end of the first year and (b) students who had not passed the BSA-criterion, but had suffered from adversary personal circumstances. These students were still allowed to continue their studies. 3 = Drop-out/unsuccessful: “not enrolling in the second year of study within the faculty”. It comprised (a) no-show students, i.e. students who finalized their registration, but never showed up (this is a small group), (b) early dropouts, i.e. students who dropped out within the first months of the program, and (c) students who had not passed the BSA-criterion at the end of the first year and had not suffered from adverse personal circumstances.	Provided by the various programs at the end of the first year (after 12 months).

Pre-enrolment data included data about students' sex, ethnic background, and type and level of achievement during the final examinations of pre-university education. Post-enrolment data included

data about students' achievement at the first two exams in the university and their success or failure at the end of the first year.

2.4. Analysis

All the data were linked based on a student ID. After linking the data, privacy of the students was guaranteed by removing the student ID from the database. All analyses were then conducted at the level of subgroups of students. Subgroups were formed on basis of the pre- and post-enrolment variables separately (e.g. men, women) and the combination of the variables (e.g. men with a western minority background and a level of achievement during pre-university between 5.5 and 6.4). For each subgroup, it was determined (a) which percentage had completed successfully the first-year program within a year after the start, (b) which percentage had suffered from study delay in the first year, but were still allowed to continue their studies, and (c) which percentage had dropped out in the first year.

3. Results

3.1. Identification of successful and unsuccessful students in the first year based on pre-enrolment variables

Table 2 presents the first-year performance for men and women. It appears that women outperformed

men. Fifty-seven percent of the women completed successfully the first academic year, where this percentage for men was 47%. The dropout rate for women (23%) was 7% lower than for men (30%). Although sex seems to play a role in student success, this variable alone seems not sufficient to identify “reliably” successful and unsuccessful students at an early stage.

Table 3 presents the first-year performance for subgroups of students based on their ethnic background. It is shown that non-western minority students in particular were doing relatively poorly: only 42% of this group successfully completed the first year. This percentage was more than 10% lower than that of the majority and western minority group (respectively 56% and 53% successful). Moreover, the dropout rate in the non-western minority subgroup (33%) was 7–8 percent point higher than in the other two groups. Although the ethnic background seems to play a role in student success at the university, this variable alone seems not sufficient to identify “reliably” at an early stage successful and unsuccessful students.

Table 4 presents the first-year performance for subgroups of students based on the type of pre-university education they followed and their level of achievement during the final examination of pre-university education. Compared to sex and ethnic background, the type and level of achievement of

Table 2. Study success in the first year for subgroups formed on basis of their sex.

Subgroups	N	Performance in the first year at the university		
		Successful completion	Pass to year 2 with delay	Dropout/unsuccessful
Men	13,417	47%	22%	30%
Women	11,559	57%	20%	23%

Table 3. Study success in the first year for subgroups of students formed on basis of their ethnic background.

Subgroups	N	Performance in the first year at the university		
		Successful completion	Pass to year 2 with delay	Dropout/unsuccessful
Non-western minority students	5907	42%	25%	33%
Western minority students	3801	53%	21%	26%
Majority students	15,268	56%	20%	25%

Table 4. Study success in the first year for subgroups of students formed on basis of the type and level of achievement of pre-university education.

Subgroups	N	Performance in the first year at the university		
		Successful completion	Pass to year 2 with delay	Dropout/unsuccessful
Pre-university education GPA ≥ 5.5 and ≤ 6.4	5935	36%	23%	41%
Pre-university education completed abroad	3151	50%	22%	28%
Higher professional education first year completion certificate	2673	50%	17%	33%
Pre-university education GPA ≥ 6.5 and ≤ 7.4	10,941	56%	23%	21%
Pre-university education GPA ≥ 7.5	2276	78%	13%	8%

pre-university education seemed to be a better “predictor” of successful and unsuccessful students. Especially students with a low pre-university education GPA (5.5–6.4) were doing poorly: only 36% completed successfully the first year within a year. In contrast, students with a high GPA (≥ 7.5) during pre-university education were quite successful in the first year: 78% completed successfully the first year. Of the former group (GPA between 5.5 and 6.4) 41% dropped out, of the latter group only 8%.

Table 5 presents the first-year performance for subgroups of students formed on basis of the combination of sex, ethnic background and type and level of achievement of pre-university education. The data in this table clearly show that the most important pre-enrolment variable to identify successful and unsuccessful students in the first year was their level of performance during pre-university education. The weakest groups at the university (lowest successful completion rates; highest dropout rates) were those who already performed less well before they entered the university. Almost all

subgroups with a pre-university education GPA between 5.5 and 6.4, independent of their sex and ethnic background, were really doing poorly at the university (see light grey cells in Table 5): only 29–34% of the students of these subgroups successfully completed the first academic year and 40–47% dropped out. There was one exemption: compared to the other subgroups female students with a majority background and a pre-university GPA between 5.5 and 6.4 performed relatively well at the university: of this group 48% completed successfully the first academic year and 31% dropped out.

Based on the combination of the values of the pre-enrolment variables the best performing groups at the university all had the characteristic ‘GPA obtained during the final examination of pre-university education ≥ 7.5 ’ (see dark grey cells in Table 5). All these groups, independent of their sex and ethnic background, performed well in the first year: between 74 and 82% of the students in these groups completed successfully the first year and only 5–10% dropped out.

Table 5. Study success in the first year for subgroups formed on the basis of the combination of pre-enrolment data.

Sex	Ethnic background	Type and level of achievement pre-university education	N	Performance in the first year at the university		
				Successful completion	Pass to year 2 with delay	Dropout / unsuccessful
Men	W minority students	Pre-univ educ GPA 5.5 - 6.4	291	29%	24%	47%
Men	Non W minority students	Pre-univ educ GPA 5.5 - 6.4	844	29%	25%	46%
Women	W minority students	Pre-univ educ GPA 5.5 - 6.4	208	32%	28%	40%
Women	Non W minority students	Pre-univ educ GPA 5.5 - 6.4	726	33%	26%	41%
Men	Majority students	Pre-univ educ GPA 5.5 - 6.4	2,533	34%	21%	45%
Men	Non W minority students	Pre-univ educ completed abroad	511	37%	28%	36%
Men	Non W minority students	Higher prof educ 1 st yr completed	412	38%	23%	40%
Women	Non W minority students	Higher prof educ 1 st yr completed	657	40%	20%	41%
Women	Non W minority students	Pre-univ educ completed abroad	554	40%	26%	35%
Men	Majority students	Pre-univ educ completed abroad	164	43%	20%	37%
Men	W minority students	Pre-univ educ GPA 6.5 - 7.4	475	45%	22%	33%
Men	Non W minority students	Pre-univ educ GPA 6.5 - 7.4	907	45%	28%	28%
Women	Majority students	Pre-univ educ GPA 5.5 - 6.4	1,333	48%	22%	31%
Men	W minority students	Higher prof educ 1 st yr completed	76	50%	16%	34%
Women	W minority students	Higher prof educ 1 st yr completed	145	53%	15%	32%
Women	Majority students	Pre-univ educ completed abroad	133	53%	20%	28%
Men	W minority students	Pre-univ educ completed abroad	1,078	53%	21%	25%
Women	Non W minority students	Pre-univ educ GPA 6.5 - 7.4	1,038	53%	28%	19%
Men	Majority students	Pre-univ educ GPA 6.5 - 7.4	4,579	54%	24%	23%
Men	Majority students	Higher prof educ 1 st yr completed	506	56%	15%	29%
Women	W minority students	Pre-univ educ GPA 6.5 - 7.4	395	58%	24%	19%
Women	Majority students	Higher prof educ 1 st yr completed	635	59%	13%	28%
Women	W minority students	Pre-univ educ completed abroad	953	62%	18%	20%
Women	Majority students	Pre-univ educ GPA 6.5 - 7.4	3,547	65%	18%	16%
Women	Non W minority students	Pre-univ educ GPA ≥ 7.5	151	74%	18%	8%
Men	Non W minority students	Pre-univ educ GPA ≥ 7.5	107	75%	15%	10%
Men	Majority students	Pre-univ educ GPA ≥ 7.5	850	75%	16%	9%
Women	W minority students	Pre-univ educ GPA ≥ 7.5	96	77%	15%	8%
Men	W minority students	Pre-univ educ GPA ≥ 7.5	84	77%	18%	5%
Women	Majority students	Pre-univ educ GPA ≥ 7.5	988	82%	10%	8%

3.2. Identification of successful and unsuccessful students in the first year based on post-enrolment variables

Table 6 presents the first-year performance for subgroups of students based on their performance at the first two exams in the university. The data in this table suggest that students' performance at the first two exams could well be used to identify successful students and unsuccessful students at an early stage in the university. Of the students who did not pass at least one of the first two exams only 11% completed successfully the first year and a 63% dropped out. In contrast, of the students who passed the first two exams 79% completed successfully the first year and only 7% dropped out.

3.3. Identification of successful and unsuccessful students in the first year based on the combination of pre- and post-enrolment variables

Table 7 presents the first-year performance for subgroups of students formed on basis of the combination of pre-enrolment variables (sex, ethnic background, and type and level of achievement of pre-university education) and post-enrolment variables (performance at the first two exams in the university). Based on the combination of these variables subgroups with very low success rates and high dropout rates in the first year could be identified. Of students in the first 15 subgroups in Table 7 (see light grey cells; all together 2465 students) less than 10% completed successfully the first year. In most of these groups 65% or an even a higher percentage of students dropped out. All these subgroups had one characteristic in common: They did not successfully completed any of the first two exams in the first year. In addition to this characteristic, other important characteristics were “a pre-university GPA between 5.5 and 6.4” or “pre-university education completed abroad”. Remarkably, within the list of the 15 most susceptible subgroups, also subgroups of students with a pre-university GPA ≥ 7.5 were included (in combination with the characteristic “not passed any of the first two

exams”). However, it should be noted that the size of those subgroups was really small.

The last 10 subgroups of Table 7 are the best performing groups (see dark grey cells; all together 4723 students). Of students in these groups more than 80% completed successfully the first year and less than 10% dropped out. The very best groups all had the first two exams at the university completed successfully. In addition, the top-6 subgroups all had a pre-university education GPA of 7.5 or higher. Furthermore, it is interesting to note that the best performing groups showed a mix of men and women and students with different ethnic backgrounds.

4. Discussion

The goal of this study was to investigate how precisely at an early stage successful and unsuccessful students in the first year at the university could be identified based on a combination of (a) students' pre-enrolment data (sex, ethnic background, type and level of achievement during pre-university education) and (b) data available very early after enrolment at the university (achievement of students at the first two written exams).

It turned out to be possible to identify, already before enrolment, subgroups of students with a high chance of becoming successful or unsuccessful. The most important pre-enrolment variable was students' level of performance during pre-university education: almost all students with a low pre-university education GPA (5.5–6.4) had a “low chance” of becoming successful (29–34%) and a “high chance” of dropping out (40–47%) in the first academic year. In contrast, subgroups of students with a high pre-university education GPA (≥ 7.5) had a “high chance” of becoming successful (74–82%) and a “low chance” of dropping out (5–10%). These results are in line with what is already known in literature about the predictive value of students' achievement during pre-university education [17,23,24]. An interesting additional finding of this study was that students' sex or ethnic background does not seem to add to the “predictive value” of their level of achievement during pre-university education.

Table 6. Study success in the first year for subgroups formed on the basis of their performance at the first two exams in the university.

Subgroups	N	Performance in the first year at the university		
		Successful completion	Pass to year 2 with delay	Dropout/unsuccessful
0 exams completed successfully	5799	11%	26%	63%
1 exam completed successfully	6774	38%	31%	32%
2 exams completed successfully	12,403	79%	14%	7%

Table 7. Study success in the first year for subgroups of students formed on the basis of the combination of pre- and post-enrolment data.

Sex	Ethnic background	Type and level of achievement pre-university education	Performance on first 2 exams	N	Performance in the first year at the university		
					Successful completion	Pass to year 2 with delay	Dropout / unsuccessful
Women	NW minority students	Pre-univ educ GPA ≥ 7.5	0 exams completed	10	0%	30%	70%
Men	W minority students	Pre-univ educ GPA ≥ 7.5	0 exams completed	6	0%	67%	33%
Women	W minority students	Pre-univ educ GPA ≥ 7.5	0 exams completed	6	0%	67%	33%
Men	NW minority students	Pre-univ educ completed abroad	0 exams completed	164	3%	31%	67%
Men	Majority students	Pre-univ educ completed abroad	0 exams completed	54	6%	19%	76%
Men	W minority students	Pre-univ educ GPA 5.5 - 6.4	0 exams completed	120	6%	19%	75%
Women	NW minority students	Pre-univ educ completed abroad	0 exams completed	175	6%	23%	71%
Men	Majority students	Pre-univ educ GPA 5.5 - 6.4	0 exams completed	913	7%	20%	73%
Women	W minority students	Pre-univ educ GPA 5.5 - 6.4	0 exams completed	66	8%	21%	71%
Men	NW minority students	Pre-univ educ GPA 5.5 - 6.4	0 exams completed	361	8%	22%	70%
Men	NW minority students	Pre-univ educ GPA ≥ 7.5	0 exams completed	13	8%	54%	39%
Women	W minority students	Higher prof educ 1 st yr completed	0 exams completed	32	9%	9%	81%
Women	NW minority students	Higher prof educ 1 st yr completed	0 exams completed	234	9%	19%	72%
Men	W minority students	Pre-univ educ GPA 6.5 - 7.4	0 exams completed	106	9%	23%	68%
Men	W minority students	Pre-univ educ completed abroad	0 exams completed	205	9%	25%	66%
Women	NW minority students	Pre-univ educ GPA 5.5 - 6.4	0 exams completed	250	10%	28%	63%
Men	NW minority students	Pre-univ educ GPA 6.5 - 7.4	0 exams completed	264	10%	30%	60%
Men	NW minority students	Higher prof educ 1 st yr completed	0 exams completed	163	11%	25%	64%
Women	Majority students	Higher prof educ 1 st yr completed	0 exams completed	147	12%	18%	70%
Men	W minority students	Higher prof educ 1 st yr completed	0 exams completed	25	12%	24%	64%
Men	Majority students	Pre-univ educ GPA 6.5 - 7.4	0 exams completed	896	13%	30%	57%
Men	Majority students	Pre-univ educ GPA ≥ 7.5	0 exams completed	106	13%	52%	35%
Women	Majority students	Pre-univ educ GPA 5.5 - 6.4	0 exams completed	350	14%	25%	62%
Women	W minority students	Pre-univ educ GPA 6.5 - 7.4	0 exams completed	72	15%	26%	58%
Women	Majority students	Pre-univ educ GPA ≥ 7.5	0 exams completed	75	15%	35%	51%
Women	NW minority students	Pre-univ educ GPA 6.5 - 7.4	0 exams completed	228	15%	34%	51%
Women	Majority students	Pre-univ educ completed abroad	0 exams completed	28	18%	11%	71%
Women	Majority students	Pre-univ educ GPA 6.5 - 7.4	0 exams completed	472	18%	31%	51%
Women	W minority students	Pre-univ educ completed abroad	0 exams completed	135	19%	24%	57%
Men	Majority students	Higher prof educ 1 st yr completed	0 exams completed	123	20%	12%	68%
Women	NW minority students	Pre-univ educ GPA 5.5 - 6.4	1 exam completed	272	29%	30%	41%
Men	Majority students	Pre-univ educ GPA 5.5 - 6.4	1 exam completed	849	30%	26%	44%
Men	NW minority students	Pre-univ educ GPA ≥ 7.5	1 exam completed	10	30%	30%	40%
Men	W minority students	Pre-univ educ GPA 5.5 - 6.4	1 exam completed	98	31%	30%	40%
Men	NW minority students	Pre-univ educ GPA 5.5 - 6.4	1 exam completed	293	31%	31%	38%
Women	W minority students	Pre-univ educ GPA 5.5 - 6.4	1 exam completed	77	31%	34%	35%
Women	NW minority students	Pre-univ educ completed abroad	1 exam completed	157	31%	36%	34%
Women	W minority students	Higher prof educ 1 st yr completed	1 exam completed	37	32%	30%	38%
Men	W minority students	Pre-univ educ completed abroad	1 exam completed	260	32%	30%	37%
Women	NW minority students	Higher prof educ 1 st yr completed	1 exam completed	195	34%	26%	40%
Men	NW minority students	Pre-univ educ completed abroad	1 exam completed	145	35%	31%	35%
Men	Majority students	Pre-univ educ GPA 6.5 - 7.4	1 exam completed	1283	35%	36%	29%
Men	W minority students	Pre-univ educ GPA 6.5 - 7.4	1 exam completed	155	37%	25%	39%
Men	NW minority students	Pre-univ educ GPA 6.5 - 7.4	1 exam completed	268	38%	38%	24%
Men	NW minority students	Higher prof educ 1 st yr completed	1 exam completed	110	39%	25%	36%
Men	Majority students	Pre-univ educ completed abroad	1 exam completed	44	41%	30%	30%
Women	NW minority students	Pre-univ educ GPA 6.5 - 7.4	1 exam completed	310	41%	39%	20%

Table 7. (Continued).

Sex	Ethnic background	Type and level of achievement pre-university education	Performance on first 2 exams	N	Performance in the first year at the university		
					Successful completion	Pass to year 2 with delay	Dropout / unsuccessful
Men	Majority students	Higher prof educ 1 st yr completed	1 exam completed	141	43%	23%	33%
Women	W minority students	Pre-univ educ GPA >=7.5	1 exam completed	14	43%	43%	14%
Men	W minority students	Higher prof educ 1 st yr completed	1 exam completed	16	44%	13%	44%
Women	Majority students	Pre-univ educ GPA 5.5 - 6.4	1 exam completed	458	44%	26%	30%
Women	Majority students	Pre-univ educ completed abroad	1 exam completed	45	44%	31%	24%
Women	NW minority students	Pre-univ educ GPA >=7.5	1 exam completed	25	44%	48%	8%
Women	Majority students	Higher prof educ 1 st yr completed	1 exam completed	159	45%	20%	35%
Women	W minority students	Pre-univ educ completed abroad	1 exam completed	229	45%	29%	26%
Women	W minority students	Pre-univ educ GPA 6.5 - 7.4	1 exam completed	114	45%	39%	17%
Women	Majority students	Pre-univ educ GPA 6.5 - 7.4	1 exam completed	834	47%	30%	23%
Women	Majority students	Pre-univ educ GPA >=7.5	1 exam completed	77	53%	31%	16%
Men	Majority students	Pre-univ educ GPA >=7.5	1 exam completed	91	53%	35%	12%
Women	W minority students	Pre-univ educ GPA 5.5 - 6.4	2 exams completed	65	57%	29%	14%
Men	W minority students	Pre-univ educ GPA >=7.5	1 exam completed	8	63%	25%	13%
Men	W minority students	Pre-univ educ GPA 5.5 - 6.4	2 exams completed	73	64%	26%	10%
Men	NW minority students	Pre-univ educ completed abroad	2 exams completed	202	65%	23%	11%
Women	NW minority students	Pre-univ educ GPA 5.5 - 6.4	2 exams completed	204	67%	19%	15%
Men	NW minority students	Pre-univ educ GPA 5.5 - 6.4	2 exams completed	190	67%	21%	13%
Men	NW minority students	Higher prof educ 1 st yr completed	2 exams completed	139	68%	19%	14%
Men	W minority students	Pre-univ educ GPA 6.5 - 7.4	2 exams completed	214	68%	21%	11%
Men	Majority students	Pre-univ educ GPA 5.5 - 6.4	2 exams completed	771	69%	19%	13%
Women	Majority students	Pre-univ educ GPA 5.5 - 6.4	2 exams completed	525	73%	17%	11%
Women	NW minority students	Pre-univ educ completed abroad	2 exams completed	222	73%	21%	7%
Men	Majority students	Pre-univ educ completed abroad	2 exams completed	66	74%	15%	11%
Men	NW minority students	Pre-univ educ GPA 6.5 - 7.4	2 exams completed	375	74%	19%	8%
Women	Majority students	Pre-univ educ completed abroad	2 exams completed	60	75%	15%	10%
Women	NW minority students	Higher prof educ 1 st yr completed	2 exams completed	228	75%	16%	9%
Women	NW minority students	Pre-univ educ GPA 6.5 - 7.4	2 exams completed	500	77%	18%	4%
Women	W minority students	Pre-univ educ completed abroad	2 exams completed	589	78%	13%	9%
Men	Majority students	Pre-univ educ GPA 6.5 - 7.4	2 exams completed	2400	78%	15%	7%
Men	W minority students	Pre-univ educ completed abroad	2 exams completed	613	78%	16%	7%
Women	W minority students	Pre-univ educ GPA 6.5 - 7.4	2 exams completed	209	79%	15%	6%
Men	W minority students	Higher prof educ 1 st yr completed	2 exams completed	35	80%	11%	9%
Men	Majority students	Higher prof educ 1 st yr completed	2 exams completed	242	81%	12%	7%
Women	W minority students	Higher prof educ 1 st yr completed	2 exams completed	76	82%	9%	9%
Women	Majority students	Pre-univ educ GPA 6.5 - 7.4	2 exams completed	2241	82%	12%	6%
Women	Majority students	Higher prof educ 1 st yr completed	2 exams completed	329	86%	8%	6%
Men	W minority students	Pre-univ educ GPA >=7.5	2 exams completed	70	86%	13%	1%
Women	NW minority students	Pre-univ educ GPA >=7.5	2 exams completed	116	87%	10%	3%
Men	Majority students	Pre-univ educ GPA >=7.5	2 exams completed	653	89%	7%	4%
Women	W minority students	Pre-univ educ GPA >=7.5	2 exams completed	76	90%	5%	5%
Women	Majority students	Pre-univ educ GPA >=7.5	2 exams completed	836	91%	5%	4%
Men	NW minority students	Pre-univ educ GPA >=7.5	2 exams completed	84	91%	7%	2%

Pre-enrolment variables clearly do have value in identifying successful and unsuccessful students. However, the findings of the current study suggest that by including post-enrolment information successful and unsuccessful students could be identified with even higher precision. Specifically, student achievement on the first two written exams in university turned out to be an important variable. Students who pass these first two exams have a “positive prospect” for completing successfully the first year (79%). By contrast, students who are unsuccessful at the start of their studies, i.e. fail to pass both first two written exams at the university, have a “high risk of dropping out” (63%). The findings of this study with respect to the relationship between student achievement early in the first year and

subsequent success was also reported earlier by others [11,25,26,28]. The contribution of the current study to this literature is the combination of pre- and post-enrolment data to improve the identification of successful and unsuccessful students in the first year. By combining the values of the pre- and post-enrolment variables at a very early stage in the first academic year on the one side subgroups of students (together 2465 students) with a “very small chance” of completing successfully the first year (<10%) and a “high chance” of dropping out (>65%) could be identified (see light grey cells in Table 7). And on the other side, subgroups (together 4723 students) with a very “high chance” of successfully completing the first year (>80%) and a very small chance of dropping out (<10%) (see dark grey cells

in Table 7). These findings seem to be quite spectacular, since only a very small number of data from students was used, most of which were collected automatically.

For the groups of students with a “high chance” of dropping out it seems to be wise to intervene at an early stage in the first year. After all, if nothing is done, the majority of these students will drop out. It might be interesting to explore what appropriate interventions could be. Perhaps for part of the students a tailor-made remedial support program might help. However, it is conceivable that for other students there is no match with the bachelor program and therefore referral to another program within or outside the university is the best option. If the latter is true, it is important that the curriculum is flexible, i.e. that students have the opportunity to enrol in another program in the course of an ongoing year without losing (too much) time.

For the groups of students with a very “high chance” of successful completion, it seems interesting to investigate how those students can develop even further. Most of those students are stable good performers, i.e. they already had a high GPA during pre-university education and continued to be successful at the first two exams in the university. It is conceivable that they have the capacity to engage in more challenging study-related activities than presently offered to them.

There seem to be no important (methodological) limitations to this study. In this study only factual data about students were used and combined, and data about entire cohorts of students.

In conclusion, it was shown that it is certainly possible to identify successful and unsuccessful students at a very early stage in the university. The most important “predicting” variables are students’ performance early in the first year at the university and their level of achievement during the final year of pre-university education. The challenge for the future is to investigate what appropriate interventions can be developed for the “vulnerable” and “strong” students. The end goal should be that more students are successful in the end, that all talent is optimally developed and that the scarce resources for education are spend in the most optimal way.

Conflict of interest

There is no conflict of interest.

Ethical approval

None.

Other disclosure

None.

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