Guiding Students' Transition to University: Which Student Factors to Include?

Erna Nauwelaerts[1], Sarah Doumen[1,2] & Guido Verhaert[1]

[1] School of Educational Studies, Hasselt University, Diepenbeek, Belgium

[2] The Faculty of Sciences, Hasselt University, Diepenbeek, Belgium

Correspondence: Erna Nauwelaerts, Hasselt University, School of Educational Studies, Research group U-RISE, Wetenschapspark 24, 3590 Diepenbeek, Belgium. E-mail: erna.nauwelaerts@uhasselt.be

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Abstract

In Belgium, pupils in their final years of high school follow an orientation trajectory towards higher education, including self-exploration tests and participation in initiatives of higher education institutions, under the supervision of their teachers. At the end of this trajectory, the teacher board advises pupils regarding their intended study choices. Belgian higher education has an open-admission system, although there exist non-binding positioning tests for some of the Bachelor degree programmes, developed at the request of the Flemish government. The aim of this study is to develop a new orientation tool to support teachers and the teacher board in their guiding role for high-school students transitioning to higher education. In cooperation with 43 high schools, important factors to be included in the instrument were investigated. Student factors rated by the teacher board such as test taking and preparation strategies, persistence and effort and factors regarding prior education were examined as predictors of students' academic performance at two higher education institutions (n = 2852). Based on this research, a prototype of a new orientation instrument is presented that takes into account high school GPA and the match between students' field of study in secondary school and their intended/chosen Bachelor programme in higher education. These factors have a high multiple correlation of approximately nearly 0.70 with academic performance at university. The other student factors considered are substantially related to study success in higher education, but appear largely incorporated into student's high school GPA.

Keywords: orientation tool, university, academic performance, high school GPA, fit between high school and university

1. Introduction

As is the case in many countries and regions, in Flanders, the Flemish-speaking part of Belgium, a lot of attention is paid to the orientation of high-school students to higher education programmes. In their final years of high school, pupils learn more about themselves including their strengths and interests, and in the context of this transition, they get acquainted with higher education and the different professions through various initiatives initiated by the school or higher education institutions. Teachers play a guiding role in this study choice process. At the end of this trajectory, pupils usually provide the teacher board with up to three preferred choices of Bachelor programmes. The teacher board then gives its (non-binding) advise about these possible choices.

Unlike in many other countries or regions, there is an open-admission system in Belgium, which means that pupils with a high school diploma can enrol in almost any Bachelor programme without passing a selection procedure. Recently, however, some tests were developed by higher education institutions at the request of the Flemish government. An obligatory, non-binding exploration and orientation tool is constructed for pupils in their final high-school years, i.e. the Columbus exploration tool (Demulder, Lacante, & Donche, 2021). Furthermore, for a number of Bachelor programmes such as Engineering and Science, non-binding positioning tests are developed which focus on programme-specific prerequisite knowledge (Pinxten, Van Soom, Peeters, De Laet, & Langie, 2019; Vanderoost et al., 2015). Pupils take part in these tests in the summer recess, prior to transitioning into higher education.

Tests have their pitfalls and limitations, as reported repeatedly by international literature (Drenth & Sijtsma, 2006; Fischer, Schult, & Hell, 2013; Hiss & Franks, 2014; Nauwelaerts & Doumen, 2015; Niessen & Meijer, 2015; Syverson, Franks, & Hiss, 2018). International research shows that these tests have at most a correlation of 0.50 – 0.55 with academic performance in higher education (e.g. Richardson, Abraham, & Bond, 2012). An important debate in this regard concerns the test/selection and criterium cut-off score. Together, the correlation and the cut-offs have an impact on the potentially large percentage of students unjustly receiving a positive or negative advice regarding a particular Bachelor programme. Moreover, tests can disadvantage certain groups in society (Espenshade & Chung, 2010; Fischer et al., 2013; Mau & Lynn, 2001; Sackett, Kuncel, Arneson, Cooper, & Waters, 2009; Sanchez, 2013). Furthermore, the correct interpretation and evaluation of these test results is not an easy task.

The aim of the current study was to develop a new orientation tool to support teachers and the teacher board in their guiding and advising role regarding high-school students transitioning to higher education. In cooperation with 43 high schools, important factors to be included in the instrument were investigated. Amongst others, the role of High School Grade Point Average (HSGPA) (Richardson et al., 2012; Robbins et al., 2004; Westrick, Le, Robbins, Radunzel, & Schmidt, 2015) is examined, which is not yet incorporated in a systematic, substantiated way in the orientation trajectory of pupils in Flanders.

2. Method

The research project involved three phases (Note 1). In the first phase, based on an extensive literature review, important student factors with respect to academic performance in higher education were identified by the researchers. In the second phase, in consultation with representatives of participating secondary schools, factors to be included in the project were translated to the context of high-school teacher boards. Further, data were collected in secondary and higher education. In the third phase, the predictive validity of the factors and resulting implications for practice were evaluated.

2.1 Identification of the Most Important Predictors of Academic Achievement

An extensive literature review was performed to identify the most important predictors of study success in higher education. Due to the vast amount of literature on this topic, the search in Web of Science focused primarily on meta-analyses: The results of 26 meta-analyses and other important studies were studied and summarized (e.g., Credé & Kuncel, 2008; Richardson et al., 2012; Robbins et al., 2004). The focus was on student factors, which were grouped into the following categories: entry factors including demographic variables, personality characteristics, intelligence and prior education, and factors relating to the student-in-training such as motivation/emotion, cognition, behaviour, context and integration. Table 1 below provides an overview of the predictors of study results in higher education with the strongest evidence across meta-analyses.

Table 1. Overview of the most important predictors of GPA in higher education

Student factor	Rho	Meta-analyses
ENTRY FACTORS		
Personality characteristics		
Conscientiousness	.23-.27	McAbee & Oswald (2013); O'Connor & Paunonen (2007)[**]; Poropat (2009); Richardson et al. (2012); Trapmann, Hell, Hirn, & Schuler (2007); Vedel (2014)[***]
Procrastination (-)	.16[***]-.30[*]	Credé & Kuncel (2008)[*]; Kim & Seo (2015)[***]; Richardson et al. (2012); Steel (2007)[+]; Van Eerde (2003)[***]
Intelligence		
Intelligence	.21-.23	Poropat (2009); Richardson et al. (2012)
Prior education		
High school GPA	.41-.47[***]	Burton and Ramist (2001)[***]; Richardson et al. (2012); Robbins et al. (2004); Trapmann, Hell, Weigand, & Schuler (2007)[*]; Westrick et al. (2015)[#***]
Subject-specific grades in high school	.22[*]-.31[*]	Trapmann, Hell, Weigand, et al. (2007)[*]
ACT/SAT	.33-.40	Burton & Ramist (2001)[***]; Richardson et al. (2012); Robbins et al. (2004); Sackett et al. (2009)[#***]; Westrick et al. (2015)[# ***]
Subject-specific admission test	.44[*]	Hell, Trapmann, & Schuler (2007)[*]
STUDENT-IN-TRAINING		
Motivation		
Academic self-efficacy	.21-.50	Credé & Phillips (2011); Richardson et al. (2012; even .67 when students are familiar with the tasks at hand); Robbins et al. (2004); Sitzmann & Ely (2011); Sitzmann & Yeo (2013)[**]
Grade goal	.44-.49	Richardson et al. (2012); Sitzmann & Ely (2011)
Achievement motivation	.30	Robbins et al. (2004)
Cognition		
Relating-structuring	.25[***]	Vermunt (2005)[# ***]
Test taking and test preparation strategies	.27[*]	Credé & Kuncel (2008)[*]
Self-testing	.21[*]-.27[*]	Credé & Kuncel (2008)[(#)*]
Strategic approach	.03[*]-.31	Credé & Kuncel (2008)[*]; Purdie & Hattie (1999)[***]; Richardson et al. (2012)
Behaviour		
Time management	.20-.23[*]	Credé & Kuncel (2008)[*]; Credé & Phillips (2011); Richardson et al. (2012); Sitzmann & Ely (2011)
Concentration	.18-.26[*]	Credé & Kuncel (2008)[*]; Richardson et al. (2012); Sitzmann & Ely (2011)
Persistence-effort	.23-.35	Credé & Kuncel (2008)[*]; Credé & Phillips (2011); Richardson et al. (2012); Sitzmann & Ely (2011)
Context and integration		
Academic integration	.36-.39	Credé & Niehorster (2012)[(#)]

Adapted from: Nauwelaerts, E., & Doumen, S. (2016). De belangrijkste studentfactoren voor studiesucces in het hoger onderwijs: Een grootschalig literatuuronderzoek [The most important student factors for study success in higher education: A large-scale literature review]. Tijdschrift voor Onderwijsrecht en Onderwijsbeleid (T.O.R.B.), 2015-2016 (5), 373-385. Note. Rho: (weighted) correlation reported in the meta-analyses, usually corrected for measurement errors in the predictor (student factor) and the criterion variable (study results). * Only corrected for unreliability in the criterion variable. ** Only corrected for unreliability in the student factor. *** No correction for unreliability and/or no meta-analysis. + Corrected for restriction of range. # Studies including only first-year students. (#) Research reporting results for first-year students only and for other students as well.

This overview of the predictors of study results in higher education is adapted from Nauwelaerts and Doumen (2016), who provide a more extensive review of the literature regarding predictors of GPA in higher education (i.e. entry factors and factors relating to the student-in-training). Each of the factors is discussed below.

Student factors were of interest to the project if they correlated above 0.20 with GPA in higher education, preferably in multiple meta-analyses. Concerning entry factors, conscientiousness and procrastination, intelligence tests, and certain factors reflecting students'prior education fulfilled these criteria. Meta-analyses showed that, of the Big Five personality characteristics neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (McCrae & Costa, 1997) only conscientiousness correlated ≥ .20 with study results in higher education (rho = .23 - .27; see Table 1). Conscientiousness refers to the degree a student is self-disciplined, the extent one can depend on the student and how achievement-oriented the student is (Richardson et al., 2012). Procrastination, the behavioural tendency to postpone tasks and decisions, is closely related to the concept of conscientiousness (Steel, 2007). Procrastination has a negative correlation with academic performance (Credé & Kuncel, 2008). Recently, however, researchers introduced the concept of 'active procrastination', which refers to the extent to which a student intentionally postpones tasks and gets a strong motivation to meet a deadline because of the time pressure (Choi & Moran, 2009). In contrast to the 'passive' procrastination described above, active procrastination has a positive correlation with academic success (Kim & Seo, 2015), yielding weaker negative correlations for meta-analyses including both passive and active procrastination presenting as corrected and uncorrected meta-analytic correlations between -.16 and -.30. Intelligence tests also correlated ≥.20 with academic performance in higher education, but to a lesser degree than factors reflecting students' prior education. Regarding prior education, particularly high school GPA (HSGPA) is highly correlated to academic performance in higher education e.g. ρ = .45 (Robbins et al. 2004). Furthermore, there is also some evidence that subject-specific knowledge and competencies relate to GPA in higher education (Trapmann, Hell, Weigand et al., 2007). General standardized admission tests such as the Scholastic Aptitude/Assessment Test (SAT) and the American College Test (ACT) also have a substantial correlation with study results in higher education e.g. ρ =.33 or .39 (Richardson et al. 2012; Robbins et al. 2004), but correlate lower than HSGPA. The correlations of subject-specific admission tests can be higher, but depend on the specific study programme in higher education (Hell et al., 2007).

Next to entry factors, factors related to the student-in-training were examined, specifically, motivation/emotion, cognition, behaviour, context and integration. The relationship between motivation and academic performance has been investigated extensively. Often different aspects of motivation are highlighted. Some motivational theories focus on expectancy for success e.g. Am I able to successfully complete the task/activity?, others on reasons to do the task/activity e.g. Why would I do this task/activity?, or a combination of both (Eccles & Wigfield, 2002). Regarding theories focusing on expectancy, academic self-efficacy is one of the consistent predictors of academic performance across meta-analyses i.e. a meta-analytic correlation up to .50 (Credé & Phillips, 2011; Richardson et al., 2012). It refers to people's beliefs about their capabilities to accomplish academic tasks (Bandura, 1997; Boekaerts, Pintrich, & Zeidner, 2000). With respect to theories focusing on reasons to do a task/activity, grade goal emerges as a relevant predictor of academic success, ρ = .44-.49 (Richardson et al., 2012; Sitzmann & Ely, 2011). The concept 'grade goal' is related to goal theories with respect to motivation (Robbins et al., 2004) and refers to a specific performance goal which is based on prior feedback received (Richardson et al., 2012). An additional factor to consider is achievement motivation, ρ = .30 (Robbins et al. 2004). This construct refers to the need to accomplish something and to do it well, where the motivation is in terms of needs (McClelland 1985, in Brysbaert 2006).

Regarding cognition, both cognitive processing and regulation activities were examined as predictors of academic performance in higher education.

Cognitive processing activities are activities students apply to process information, which results in knowledge, understanding, competencies, and problem solutions. Processing activities, such as memorising and rehearsal, analysing, and critical processing, had only a limited (ρ ≤.18) or inconsistent relation to academic performance in

higher education (Credé & Kuncel, 2008; Credé & Phillips, 2011; Richardson et al., 2012; Sitzmann & Ely, 2011; Vermunt, 2005). The most promising cognitive processing activities seem to be relating and structuring, whereby students relate the subject matter to what they already know, such as other subject material, prior knowledge, and structure the learning content into a whole (Vermunt, 2005). The student factor 'relating-structuring', which stems from the learning strategies approach of Vermunt (1992), has been shown to have a relation to academic performance across academic disciplines, r =.25 (Vermunt, 2005). Vermunt's (2005) study was, however, not a meta-analysis. In line with this, meta-analyses report supporting evidence regarding related processing activities, such as selecting main ideas and elaboration including linking new information to already acquired knowledge (Credé & Kuncel, 2008; Credé & Phillips, 2011; Richardson et al., 2012; Sitzmann & Ely, 2011).

Based on research regarding cognitive processing activities and aspects of motivation, the literature distinguishes different learning strategies, such as deep, surface and strategic (Credé & Kuncel, 2008). Of these study strategies, only the strategic strategy correlated ≥.20 with academic performance in higher education in the meta-analyses, ρ = .31 (Richardson et al., 2012). Applying a strategic strategy means that the student aims to achieve high grades and organizes their study strategies accordingly i.e. applying cognitive processing activities/strategies depending on the subject at hand.

The role of cognitive regulation activities was also examined. Cognitive regulation activities refer to the activities students use to plan, monitor and evaluate their learning process (Vermunt, 1992). Particularly two cognitive regulation activities are of interest: test preparation and test taking strategies and self-testing, with a partially corrected correlation up to .27 (Credé & Kuncel, 2008). The first assesses the degree to which students are able to employ test taking and preparation strategies; self-testing reflects the degree to which students use techniques to monitor their level of understanding of the subject matter (Credé & Kuncel, 2008; Dunlosky, Rawson, Marsh, Nathan, & Willingham, 2013).

Regarding (the regulation of) behaviour, time management, concentration, and particularly persistence-effort emerged as predictors (Credé & Kuncel, 2008; Credé & Phillips, 2011; Richardson et al., 2012; Sitzmann & Ely, 2011). Persistence-effort reflects the level of persistence and effort a student shows when confronted with challenging academic tasks or situations, with a meta-analytic correlation up to .35 with academic performance in higher education (Richardson et al., 2012). Time management refers to how well a student is able to self-regulate time and activities in the academic context (Credé & Kuncel, 2008; Richardson et al., 2012), for example the degree to which a student uses time efficiently, makes realistic time schedules and keeps them, is able to deal with distractions, does not postpone tasks, with a partially corrected correlation up to .23 (Credé & Phillips, 2011). Concentration has been examined separately e.g. partially corrected correlation of .26 (Credé & Kuncel, 2008), and concerns the degree to which a student is able to direct and maintain attention to study tasks (Credé & Kuncel, 2008).

Finally, students commit to and integrate in the study context i.e., the institution, degree programme, faculty staff, peers (Tinto, 1993). With respect to academic performance in higher education, particularly academic integration plays a key role e.g. ρ =.39 (Credé & Niehorster, 2012), which reflects the degree to which a student has adapted to the academic demands of their study context (Baker & Siryk, 1984, in Credé & Niehorster, 2012).

2.2 Translation of Factors to Practice and Data Collection

2.2.1 Specification of Factors in Consultation with Secondary Schools

In the next phase, secondary schools in Flanders, Belgium were invited to a number of information sessions. During these sessions, the project was introduced and the most important factors from the literature review reported earlier in Table 1 were presented schematically to school representatives, seen here as Figure 1. Figure 1 is based on the results of the meta-analyses and is in line with models such as Biggs' 3P model of teaching and learning (Presage – Process – Product; Biggs, Kember, & Leung, 2001).

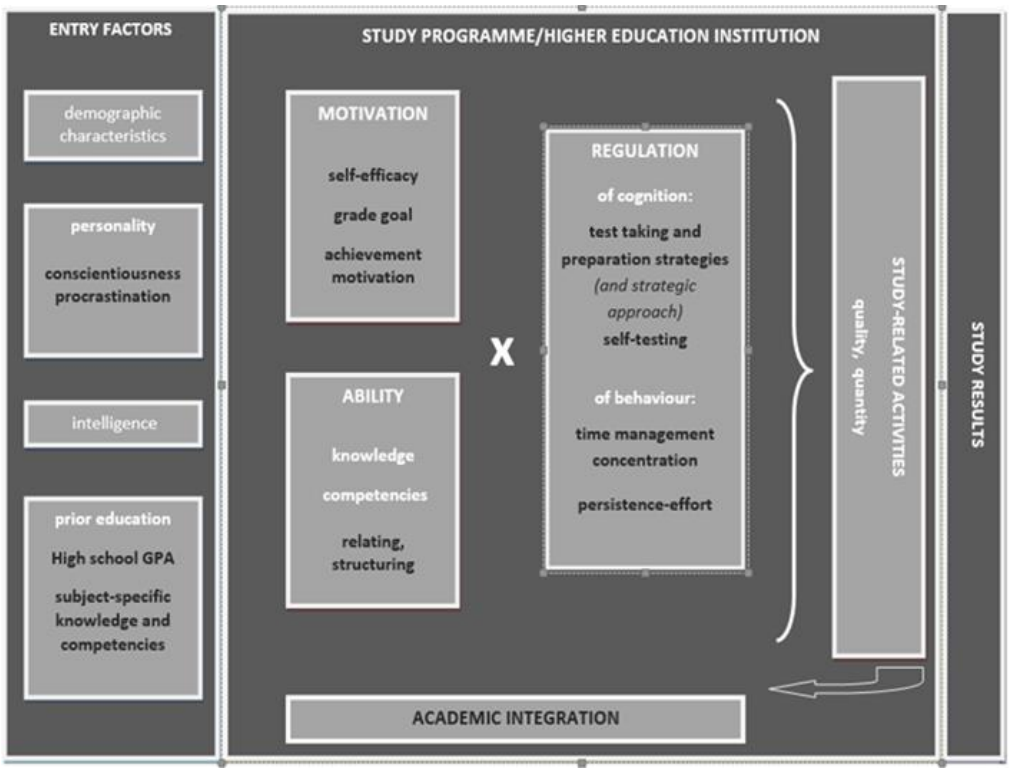

Figure 1. Schematic summary of the literature review regarding predictors of academic performance in higher education (Adapted from: Nauwelaerts, E., & Doumen, S. (2016). De belangrijkste studentfactoren voor studiesucces in het hoger onderwijs: Een grootschalig literatuuronderzoek [The most important student factors for study success in higher education: A large-scale literature review]. Tijdschrift voor Onderwijsrecht en Onderwijsbeleid (T.O.R.B.), 2015-2016 (5), 373-385.)

In consultation with the participating high schools, factors to be included in the project were specified and translated for use by high-school teacher boards.

Regarding entry factors, particularly high school GPA and subject-specific knowledge and competencies predicted academic performance in higher education as presented in Table 1. Hence, high school GPA was selected to be included in the project. Moreover, this factor is readily available to secondary schools. This factor had a higher correlation to academic performance in higher education than scores on intelligence tests. In addition, students' educational track in secondary school was registered. As the effect of conscientiousness on academic performance in higher education may proceed indirectly via persistence-effort (Richardson et al., 2012), and because of its relation to procrastination (Steel, 2007), conscientiousness was not retained.

Concerning the student-in-training, factors were categorized into motivation (study will), ability (study skill), and self-regulation (Credé & Kuncel, 2008). With respect to motivation, academic self-efficacy was included, as it had one of the higher correlations to academic success (cf. above). Grade goal and achievement motivation were too difficult to disentangle for teachers. It has been opted to include grade goal in the project. Further, relating-structuring was enclosed as one of the indicators of ability. Relating and structuring were the most promising cognitive activities with respect to academic performance in higher education. Regarding regulation, both cognitive and behavioural aspects were considered. With respect to regulation of cognition, test preparation and test taking strategies were selected, which seem to be conceptually related to strategic processing. Self-testing, however, was found to be too difficult to observe by teachers and was omitted. Further, all indicators of regulation of behaviour were included in the project. Particularly persistence-effort was a factor schools recognized to be important. Procrastination was enclosed into a broad time management construct, as was concentration. Finally, given the importance of academic integration, a similar construct was included in the project, measuring pupils' adaptation to a new learning environment in high school.

2.2.2 Measurement Instruments and Data Collection

Measurement instruments. The measurement instrument for secondary schools focused on teacher boards. Teachers are trained in evaluating pupils and, as participants of the teacher board, they play an important advisory role for pupils transitioning to higher education (cf. supra). Teacher boards were asked to evaluate pupils' academic self-efficacy, grade goal, relating-structuring, test taking and preparation strategies, time management, persistence-effort, and adaptation to a new learning environment. To this end, a scoring guide with a detailed description of each construct was provided to the schools as seen in the definitions in Table 2 below.

Table 2. Definition of student factors evaluated by the teacher board in the final year of high school

Student factor	Definition
Self-efficacy	(the student) believes that (s)he has the necessary competencies to be successful at school
Grade goal	aims high
Relating- structuring	is able to make connections between learning contents/subjects and to structure the learning content
Test taking and preparation strategies	can adequately prepare and take tests/evaluations
Time management	makes realistic time schedules, meets deadlines and uses time efficiently
Persistence-effort	persists and makes an effort
Ability to adapt (to a new learning environment)	performs well in a new learning environment

Teacher boards evaluated high-school students digitally regarding these factors by means of a 4-point scale ranging from largely unsatisfactory to largely satisfactory. Additionally, important and readily available factors regarding students' prior educational background were registered. Included were high school GPA, whether the student followed the general, technical or art programme in high school, the combination of subjects chosen in secondary education, and number of mathematics hours each week. The latter are relevant educational background factors to consider for students enrolling in higher education (de Koning, Loyens, Rikers, Smeets, & van der Molen, 2012; Masui, Broeckmans, Doumen, Groenen, & Molenberghs, 2012; Pinxten et al., 2019; Trapmann, Hell, Weigand, et al., 2007).

To validate the instrument for the teacher board, the students' perspective with respect to the student factors in Table 2, was also assessed by means of a self-report questionnaire for students. Finally, the academic achievement of the students subsequently entering higher education was gathered.

Data collection. Three cohorts of students were tracked from their final year of high school up until their enrolment at two higher education institutions during the academic years 2015-2016, 2016-2017 and 2017-2018. Approximately 43 schools in the Limburg region of Belgium were involved. Data were available for 2852 students who were evaluated by the teacher board and were enrolled in a Bachelor programme at Hasselt University (Note 2) and KU Leuven, of which 52.6% were girls and 92.7% followed the general programme in secondary school. Study results at the end of the first-year were considered, i.e. first-year GPA including September exam results were obtained from the institutions' databases. In case of multiple enrolments and re-orientation, the first enrolment was included in the analyses. Approximately 84% of the students enrolled for 57 or more credits. As the student factors evaluated by the teacher board were registered by means of a 4-point scale, these factors were considered to be categorical.

3. Results

3.1 Student Factors Evaluated by the Teacher Board

The association between each of the student factors rated by the teacher board and study results in higher education are reported in Table 3. In this table, the association among student factors is presented, as well as the mean, standard deviation, range and number of available cases for each variable.

Table 3. Descriptive statistics and associations for student factors rated by the teacher board (n=2629-2763)

	FYGPA	Test taking & preparation strategies	Time management	Persistence-effort	Grade goal	Relating-structuring	Ability to adapt	Self-efficacy
Test taking & preparation strategies	.41				.			
Time management	.40	.68						
Persistence-effort	.39	.66	.71					
Grade goal	.38	.61	.63	.71				
Relating-structuring	.35	.60	.50	.44	.43			
Ability to adapt	.28	.54	.46	.42	.40	.55		
Self-efficacy	.21	.40	.33	.27	.34	.47	.48	
Mean	50.93	3.14	3.07	3.14	3.10	3.11	3.19	3.23
SD	15.81	0.66	0.74	0.74	0.74	0.66	0.58	0.59
Range	0-92	1-4	1-4	1-4	1-4	1-4	1-4	1-4
No. cases	2763	2724	2851	2851	2850	2852	2844	2845

Note. Student factors were rated by the teacher board on a 4-point scale. Kendall's tau-b was used to estimate the relation among these categorical student factors. The relation to study results in higher education was estimated by means of linear regression analyses including dummy coded teacher board ratings. All associations are significant at $p < .001$.

There are fewer cases for 'Test taking and preparation strategies' because the teacher board had an additional option for this variable: for 124 pupils (4.3%) the extra option 'Does not prepare evaluations and tests' was ticked and these students were, hence, not included in analyses concerning this variable. Particularly test taking and preparation strategies, persistence-effort, time management, and grade goal were related to first-year GPA (FYGPA), with associations ranging between .38 and .41 ($p < .001$). These student factors − three of which represent self-regulation strategies− were highly related to each other ($r = .61$-$.71$, $p < .001$). In contrast to previous research including student self-reports (e.g., Richardson et al., 2012), academic self-efficacy and ability to adapt had the lowest associations with FYGPA, that is, within the range .21-.28 ($p < .001$). Ability to adapt translates the concept of academic integration to the current educational context of secondary schools.

A regression analysis including all student factors as predictors of FYGPA yielded a total of 22 % explained variance, which corresponds to a multiple correlation of .47 ($n = 2627$). Additional analyses involving a backward procedure showed that test taking and preparation strategies, persistence-effort, grade goal, relating-structuring and time management remained significant predictors of FYGPA.

3.2 Student Factors: Self-report

Although the current project primarily focussed on teacher board ratings, a self-report questionnaire was also distributed to pupils regarding the same student factors. Cronbach's alpha is larger than .70 for all subscales, except for Self-efficacy and Ability to adapt, as seen in Table 4 below. Teacher board and student ratings of the same student factors had associations between .13 (Ability to adapt) and .43 (Persistence – effort); $p < .001$. The correlations with study success in higher education were considerably lower for student factors measured by means of the student questionnaire than for evaluations made by the teacher board (cf. Table 3).

Table 4. Descriptive statistics, Cronbach's alphas and associations for the student questionnaire

Student questionnaire	Number of items	Cronbach's alpha	N cases	Mean (SD)	Association with teacher board ratings	Correlation with FYGPA
Test taking & preparation strategies	9	.78	1593	3.07 (0.39)	.25***	.23***
Time management	15	.87	1589	2.59 (0.48)	.29***	.24***
Persistence-effort	5	.80	1596	3.15 (0.53)	.43***	.26***
Grade goal	4	.74	1641	3.06 (0.55)	.41***	.31***
Relating-structuring	7	.82	1613	3.05 (0.41)	.22***	.13***
Ability to adapt	4	.69	1640	3.00 (0.40)	.13***	.08**
Self-efficacy	4	.69	1641	3.34 (0.39)	.23***	.15***

Note. **p < .01; *** p < .001. Students responded on a 4-point scale. Correlations with FYGPA: n = 1549-1598. Associations between student and teacher board ratings of the same construct were estimated by means of linear regression analyses, including dummy coded teacher board ratings as predictors of student ratings. Test taking & preparation strategies: There are fewer cases for this variable because 20 pupils completely agreed with the statement 'I do not prepare tests and evaluations' and these students were, hence, not included in analyses concerning this variable. Time management: although this is a multidimensional concept, for the current study, all items of the student questionnaire were combined into a single scale score in order to be similar to the ratings by the teacher board. Principal component analysis showed that one factor explained 37% of the variance and that all items had factor loadings ≥.43.

3.3 Prior Education

3.3.1 High School GPA

High school GPA in the final year of secondary education as calculated by the schools, was available for 2246 pupils, in addition to student factors rated by the teacher board and FYGPA. High school GPA is often a weighted percentage i.e. weighted by the number of hours each subject was taught per week, the semester, etc., with a theoretical range between 0 and 100%. In the current study, high school GPA correlated highly with FYGPA, i.e. .60 (n = 2246; p <.001). High school GPA and student factors rated by the teacher board had a joint multiple correlation of .61 with FYGPA (n = 2132). Additional backward regression analyses showed that high school GPA is the most important predictor of FYGPA. In addition, test taking and preparation strategies and grade goal remained significant predictors of FYGPA (ΔR^2=.006, p < .01), whereas the other student factors had no significant contribution in addition to high school GPA.

The dominance of high school GPA seems to be related to the high association between the student factors rated by the teacher board and study results in secondary education (Table 5). All student factors rated by the teacher board jointly had a multiple correlation of .73 with high school GPA (n = 2132). The student factors do not only contribute to study success in higher education but also to study success in secondary school.

Table 5. Association between student factors (rated by the teacher board) and high school GPA (n = 2142-2246)

Student factors	High school GPA
Test taking & preparation strategies	.64
Time management	.61
Persistence-effort	.61
Grade goal	.57
Relating-structuring	.58
Ability to adapt	.48
Self-efficacy	.37

Note. Significant at p < .001. The relation to study results in secondary education was estimated by means of linear regression analyses, with the categorical teacher board ratings dummy coded.

3.3.2 Match between Field of Study in Secondary Education and Bachelor Degree Programme in Higher Education

A second factor with respect to prior education is the extent to which the pupils' prior education matches their Bachelor degree programme in higher education. Based on historical data with respect to study results of previous cohorts of first-year students (Flemish Database for Higher Education; 2009-2010 until 2014-2015), each combination 'high school field of study – degree programme in higher education' was given a code with respect to fit. Coding is based on the percentage of students with a particular field of study in high school that obtained ≥ 80% of the credits in the first year of their chosen degree programme in higher education. Fit codes are expressed in integers ranging from 0 (less than 10% of the students in the past obtained ≥ 80% of the credits) until 9 (at least 90% of the students obtained ≥ 80% of the credits). Combinations 'high school field of study – degree programme in higher education' with less than 10 students in the Flemish Database for Higher Education were not coded. Codes with respect to fit were then transferred to the pupils participating in the project. The fit codes had a correlation of .42 with FYGPA (n = 2708, $p < .001$).

3.3.3 Joint Contribution of Fit Codes and High School GPA

Next, high school GPA and match between field of study in secondary and higher education were included as predictors of FYGPA in a linear regression analysis. With only two factors, high school GPA and fit, 44% of the variance in FYGPA is explained (multiple correlation of .67; n = 2197), as seen in Table 6 below. The correlation between fit codes and high school GPA is r = .26 (n = 2254, $p < .001$).

Table 6. Hierarchical regression analysis for prior education variables (centered) predicting FYGPA (n = 2197)

	Model 1		Model 2	
	B (S.E.)	β	B (S.E.)	β
Constant	51.24 (0.26)***		51.24 (0.25)***	
High school GPA	1.34 (0.04)***	0.604	1.17 (0.04)***	0.53
Fit			2.65 (0.15)***	0.29
R^2	.37		.44	
F for change in R^2	1260.26***		314.29***	
(Multiple) correlation	.60		.67	

Note. Before centering: $M_{HSGPA} = 68.97$, $SD_{HSGPA} = 6.99$; $M_{fit} = 4.77$, $SD_{fit} = 1.71$. To examine whether the clustering of pupils within schools had an impact on the results of the final model (Model 2), an additional, linear mixed model was estimated with high school GPA and fit as fixed effects and a random intercept between schools. There were 43 schools, with on average 64.91 participating pupils per school (SD = 94.78; range: 4 – 466). Both high school GPA and fit remained highly significant predictors ($p < .001$). Marginal pseudo- R^2 (fixed effects) = .43, which is similar to the R^2=.44 of Model 2.

3.3.4 Additional Analyses

Additionally, the relation to number of hours of mathematics per week in the final year of high school was examined. The correlation of hours of mathematics with high school GPA was .19 (n = 2142; $p < .001$), with fit .61 (n = 2583; $p < .001$). Hours of mathematics had a correlation of .30 with FYGPA (n = 2552; $p < .001$). It was evaluated whether hours of mathematics added extra information to the prediction of FYGPA after taking high school GPA and fit into account. This was not the case: with hours of mathematics as an additional predictor, the multiple correlation with FYGPA remained .67 (n = 2040). The type of secondary education (general, technical, artistic) was not included in the analyses, because nearly 93% of the pupils entering higher education followed general secondary education.

3.4 Implementation: Towards a New Orientation Instrument

With respect to orientation towards higher education, key elements to consider are high school GPA and the match between field of study in secondary and higher education. In this study they have a joint multiple correlation of .67 with study results at the university. The other student factors considered rated by the teacher board are substantially related to study success in higher education, but they appear largely incorporated into student's high school GPA. Nevertheless, they are important factors to act upon and already in high school.

In view of the above, a new orientation instrument will be developed based on the combination of students' high school GPA and fit between field of study in secondary and higher education. The goal is to develop an instrument that can be deployed by the teacher board to support students' study choice process in the final year of secondary

education. Teacher boards may explain the information obtained from the instrument and complement it with additional relevant student information.

More specifically, the tool provides an overview of study success of students with a similar fit code, according to their high school GPA and divided in categories. Study success is expressed in terms of the percentage of credits obtained i.e. ECTS credits obtained in the first year after resits, divided by the number of active credits registered for.

Below, a preliminary version of the instrument is illustrated by means of two examples (Note 3). In the first example, a student with 'Mathematics-Sciences' as field of study in secondary education wants to study Biomedical Sciences. Mathematics-Sciences is one of the subject combinations in high school that is considered to be an adequate preparation for this degree programme. Approximately 44% of students enrolling in Biomedical Sciences studied Mathematics-Sciences in high school (Flemish Database for Higher Education; 2009-2010 until 2014-2015). The combination 'Mathematics-Sciences' and 'Biomedical Sciences' receives a fit code 5 based on historical data. Table 7 shows the study results of students participating in the project who enrolled at Hasselt University or KU Leuven and also had a fit code 5. Chances of success in higher education increase with higher HSGPA.

Table 7. Study success in the first year of higher education (Hasselt University or KU Leuven) for students with fit code 5, according to high school GPA

	Percentage of credits obtained		
High school GPA	≥80%	<50%	≤30%
[50,62] (16%)*	13%	64%	48%
[62,65] (15%)	31%	42%	30%
[65,69] (22%)	45%	30%	18%
[69,74] (24%)	63%	16%	11%
[74,100] (23%)	78%	9%	4%

Note. The preliminary instrument focuses on the first column (≥80%). Total number of students: 937. * 16% of the students with fit code 5 has a HSGPA between 50 and 62.

The second example concerns a student with the option 'Economics and Modern Languages' in high school who wishes to study Law in higher education. Note that about 20% of students enrolling in Law enter with these prior qualifications (Flemish Database for Higher Education 2009-2010 until 2014-2015). The combination 'Economics and Modern Languages' and 'Law' receives, however, only a fit code of 2 based on historical data. This low fit code is combined with student's high school GPA. Table 8 shows the study results at Hasselt University or KU Leuven of participants in the current research project who had a fit code between 0 and 3 (Note 4). The table shows that the student with fit code 2 only has a fair chance of success if he/she obtained a high HSGPA.

Table 8. Study success in the first year of higher education (Hasselt University or KU Leuven) for students with fit code 0-3, according to their high school GPA

	Percentage of credits obtained		
High school GPA	≥80%	<50%	≤30%
[50,62] (26%)*	3%	88%	78%
[62,65] (18%)	9%	70%	54%
[65,69] (20.6%)	21%	59%	35%
[69,74] (20%)	29%	56%	34%
[74,100] (16%)	45%	22%	12%

Note. The preliminary instrument focuses on the first column (≥80%). Total number of students: 457. * 26% of the students with fit code 0-3 has a HSGPA between 50 and 62.

4. Discussion

The student factors in Table 1 play a substantial role in study success in higher education: the multiple correlation with FYGPA is .47. Particularly test taking and preparation strategies, persistence-effort, grade goal, time management and relating-structuring were related to study results at university. Academic self-efficacy had, in contrast to the literature, only a limited relation to study success, as did ability to adapt. Moreover, all of these

student factors were highly related to high school GPA. This makes them important elements to consider, already in secondary education. The results of the current project support schools already working on these student factors by offering students workshops regarding time management, for example. Furthermore, their current initiatives can be extended further to include other student factors as well such as test taking and preparation strategies.

High school GPA and match between field of study in secondary and higher education have a joint multiple correlation of .67 with study results at the university, hereby explaining about 45% of the variance in study success. In comparison, most orientation and admission tools correlate .50-.55 with study success. The other student factors considered appear largely incorporated into student's high school GPA. The current article introduces a preliminary version of an orientation instrument including these two important factors for study success in higher education. The instrument can be applied by the teacher board when guiding and advising students transitioning to higher education. Teacher boards may explain the information obtained from the instrument and complement it with additional relevant student information.

The present study has some limitations that require further research. Currently, the focus is on pupils from secondary schools in Limburg, one out of five Flemish provinces: the orientation instrument should be tested in the other provinces as well. In addition, further research regarding a possible impact of students' background characteristics is needed, which could not be examined thus far because of the low number of students with diverse background characteristics in each of the categories. Future research may also take into account possible differences between schools.

In conclusion, the current project investigated key elements for study success in higher education. This resulted in a preliminary version of an orientation instrument, which includes high school GPA and the match between the field of study in secondary and higher education. The researchers aim to further develop the orientation instrument and to examine its place within the study choice process of pupils transitioning to higher education.

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Disclosure Statement

The authors report there are no competing interests to declare.

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Notes

Note 1. This project was submitted to the Belgian Privacy Commission and has been carried out in accordance with their recommendations.

Note 2. A preliminary report on the data of Hasselt University can be found in: Nauwelaerts, E., Doumen, S., Verhaert, G., Molenberghs, G., & De Schepper, L. (2018). Een nieuw oriënteringsinstrument – Met hoge correlatie met reëel studiesucces – voor de begeleiding van de studiekeuze naar de universiteit toe [A new orientation tool – with a high correlation with study success – for guiding the study choice towards university]. *Tijdschrift voor Onderwijsrecht en Onderwijsbeleid (T.O.R.B.), 2018-2019*(1-2), 90-96.

Note 3. In the future, larger sample sizes may be available, which will provide the opportunity to fine tune the instrument (e.g. according to degree programme).

Note 4. For now, some fit codes were clustered to avoid low numbers in each cell.