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Early tracking or finally leaving? Determinants of early study success in first-year university students

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ABSTRACT

Two theoretical approaches underlie this investigation of the determinants of early study success among first-year university students. Specifically, to extend Walberg's educational productivity model, this study draws on the expectancy-value theory of achievement motivation in a contemporary university context. The survey data came from 407 first-year students, and the measure of early study success reflects the weighted grade point average at two moments during their first semester. A path model reveals that the proposed extended educational productivity framework explains early study success well. The operationalised educational productivity factors (age, prior achievement, psychosocial environment, programme satisfaction, study skills) and achievement motivation (expectancy) all relate to early study success, directly or indirectly through expectancy and self-study. The two theoretical approaches jointly provide a thorough understanding of early study success. These results have notable implications for tracking students and for further research.

Introduction

In most Western countries, including the Netherlands, enrolment in higher education has increased in recent decades, driven by both government policies that aim to foster the development of a knowledge economy and increasing labour market demand for highly educated labour forces. Increasing enrolment in turn has enhanced the diversity of the student body in terms of their background characteristics, such as prior education level. Many students in this diverse group have difficulties meeting academic requirements though; poor study success rates raise concerns, especially in terms of the potential costs to society, universities, and students themselves (Beerkens-Soo and Vossensteyn 2009; Dutch Inspectorate of Education 2014). A key issue for university education policy, thus, is finding means to improve study success for this highly diverse student population. Recent changes to university contexts, including increasing student diversity and growing calls for institutions to be accountable for study success, have reinvigorated academic interest in student success.

Although literature describing factors that might contribute to study success is substantial (e.g. Richardson, Abraham, and Bond 2012), the relationships among these factors as well as why and how these factors explain study success are less clear. McIlroy and Bunting (2002) recommended an eclectic approach that includes several measures in model building to reflect the major theoretical orientations. That is, the factors included in a model should reflect a strong theoretical foundation and cover a variety of behaviours, motivations, attitudes, beliefs, personality, and affect that probably contribute to achievement. With such an approach, researchers are more likely to find an optimal model, built on factors already known to be associated with achievement. In addition to individual characteristics, the psychosocial environment influences achievement (Richardson, Abraham, and Bond 2012), so it should also be included in any conceptual model.

In Walberg's (1984) educational productivity model, the key factors relate to the student, psychosocial environment, and instruction. This model reflects a synthesis of many studies pertaining to student achievement in primary and secondary education. However, the university context differs from a primary or secondary school context in many ways, and especially in relation to the requirements for university students. These students are increasingly responsible for their own learning processes, and their emerging adulthood and the major life transitions they experience likely affect the importance of several success factors. For example, the importance of the home environment changes if university students move to the campus (Arnett 2004). Despite these differences in the context, the educational productivity factors provide valuable starting points for investigating achievement in a university context. It shows a reasonably complete picture of the complex dynamics of study success by including nine factors regarding personal and motivational factors, the psychosocial, and the learning environment.

The focus on study success during the very early stage of the academic year, i.e. the first semester, seems important, since this period is evaluated as extremely challenging. A common phenomenon is that students starting at university feel lonely, homesick, and uncertain about the academic rules and requirements, and have difficulties in becoming independent learners (Christie et al. 2008; Dias and Sá 2012). In particular during the first semester, these uncertainties can hinder their learning process. When students become acquainted with the university environment, build a new peer network, learn how to study and develop new learning strategies (Christie et al. 2008), the determinants of study success may change over time.

Educational productivity model

The educational productivity model captures nine factors, divided into three groups: (1) *students' characteristics and aptitude*, comprising students' prior achievement or ability, age or development, and motivation; (2) *environmental factors*, involving the home environment, peer environment, school environment, and mass media; and (3) *the quantity and quality of instruction* (Walberg 1984, 1986).

Based on previous studies, we extend Walberg's (1984, 1986) educational productivity model and apply it to the contemporary university context. Regarding student characteristics, mixed results have emerged for the relationship with academic achievement in higher education (Richardson, Abraham, and Bond 2012). Some studies did not find significant effects for age on academic achievement (Bruinsma and Jansen 2007; McKenzie

and Schweitzer 2001), while others found a positive relationship (Etcheverry, Clifton, and Roberts 2001; Jansen and Bruinsma 2005; Sheard 2009) or a negative relationship (Pellizzari and Billari 2012). Prior achievement is an indication of ability, which varies among university students. Most studies revealed a positive relationship between prior achievement, such as high school grades, and current academic achievement, and appeared to be an important predictor of achievement after the first semester (e.g. McIlroy and Bunting 2002; McKenzie, Gow, and Schweitzer 2004; Richardson, Abraham, and Bond 2012).

Several previous studies focused on the environmental factors. Although for university students, the home environment is still important, it is less critical than it might be for pupils in primary or secondary education. However, research findings about the effect of parents' educational level are mixed. Drop out rates are higher among first-generation students than second-generation students (Ishitani 2006; Stage and Hossler 2000), but Van den Berg and Hofman (2005) found no evidence of an influence of parents' educational level on students' study progress. The peer environment seems more important during the early days at the university. Students who have moved out of their parents' home are physically distant from sources of parental support, pushing them to depend more on support from fellow students. These peers can provide information, advice, and help with studying, as well as emotional and practical support. Thus, peer support should relate positively to early study success. Robbins et al. (2004), indeed, found that it correlates positively with retention and academic achievement. Another key environmental factor is the classroom climate, which can be measured as a sense of belonging to the university. Zepke, Leach, and Prebble (2006) indicated that students who believe they do not belong to the university think more of withdrawing. In the educational productivity model, the original measures of mass media considered hours spent watching television (Fraser et al. 1987). Today, social media affect students' lives more than television (Hattie 2009). Therefore, we replace prior operationalisations of the mass media concept with social media use, which represents passive leisure time (if not used for studying) and, appears negatively related to study success, according to a diary study among university students (George et al. 2008).

Assessments of the quality of instruction can be derived from students' satisfaction with the degree programme and faculty. Suhre, Jansen, and Harskamp (2007) measured the influence of satisfaction with a degree programme on persistence among a sample of Dutch first- and second-year law students. Beyond capabilities, satisfaction with the programme is an important driver of motivation and study behaviour and thus academic achievement. Charlton, Barrow, and Hornby-Atkinson (2006) found also that courses matching students' intrinsic interest predicted their completion. A reasonable indicator of quantity of instruction is the number of hours spent on self-studying. In Dutch higher education contexts, students are relatively free to determine how much time they spend on self-study. University students are expected to study on their own, but the amount they do so inherently varies among students; it also should relate to study success. We avoid using the measure of contact hours during lectures since within one faculty they do not vary much across early-stage students. Also, many lectures are mandatory at the start of an academic year. As previous research indicates, time spent on (self-)study relates positively with study success (Masui et al. 2014; Suhre et al. 2007; Svanum and Bigatti 2006; Torenbeek, Jansen, and Hofman 2010). Empirical findings also show that time spent studying mediates the relationship of several other factors with study success. According to Torenbeek (2011), students with higher prior achievement invest more time studying and perform better than students with

lower prior achievement. However, Plant et al. (2005) showed that students with higher prior achievement spent less time on self-study, possibly because of their lower need to spend time studying. Intuitively, time spent on self-study should be beneficial for study success, both directly and indirectly, because self-study is an active extension of instruction time. The amount of time spent on self-study should also affect students' study skills. As Plant et al. (2005) revealed, the quantity of study time exerts an effect, only when they control for both prior achievement and the quality of study time (i.e. study habits). We therefore include study skills as an indicator of the quality of study time, in addition to satisfaction with the study programme.

The original educational productivity model (Walberg 1984) includes only direct effects from educational productivity factors to achievement or learning. Yet other studies indicate that mediation models fit student data better than a direct effects model. The indirect effects revealed by Reynolds and Walberg (1991) include the mediation of prior science achievement on the effects of the home environment and motivation, as well as the mediation of instruction quantity and quality on the influences of the home environment, motivation, mass media, and peer environment. In replicating their test of the mediation model, Reynolds and Walberg (1992) found consistent support for a mediation model, such that some productivity factors influence achievement both directly and through other proximal factors.

Expectancy-value affect theory

Although the motivational factor arises in the educational productivity model too, we expect that extending the educational productivity model with elements of expectancy-value affect theory (Pintrich and de Groot 1990) will help improve our understanding of the contemporary university context. Especially, since previous studies have shown that expectancy is one of the main predictors of study success (e.g. Richardson, Abraham, and Bond 2012) and incorporating affect should be relevant, in particular among first-year students, because the current Dutch university context features several measures, such as the academic dismissal policy (e.g. Stegers-Jager and Cohen-Schotanus 2012), that put pressure on students to perform and graduate within a standard time, which may increase their failure anxiety.

Expectancy has been conceptualised in several ways (e.g. self-efficacy, control beliefs, perceived competence), but its core meaning is that people believe, to varying levels, that they are able to accomplish tasks successfully and are accountable for their own achievements. Value indicates the incentive to complete a task and can be decomposed into attainment value, or the importance of succeeding in the task; intrinsic value, or interest and enjoyment from doing the task; and utility value, or task fit with individual goals; as well as costs, defined as the amount of effort required to complete the task (Eccles et al. 1983; Pintrich and de Groot 1990; Wigfield and Eccles 1992). Affect indicates emotional reactions to a task, including fear of failure and test anxiety (Pintrich and de Groot 1990; Pintrich et al. 1991).

Credé and Phillips (2011) investigated academic performance in college students and found, with a meta-analysis of 59 studies that used the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich et al. 1991), that expectancy and value related positively to academic performance, whereas affect showed a negative relation. According to

Doménech-Betoret, Gómez-Artiga, and Lloret-Segura (2014), expectancy or belief in one's own capabilities for achieving the requirements successfully was especially important early in the academic year, because it influenced the extent to which the student was willing to put effort into studying. Previous studies tested a direct relationship between motivational beliefs (i.e. expectancy) and study success (e.g. De Clercq et al. 2013), but motivational beliefs also might mediate the relationships between the educational productivity factors and early study success. Credé and Phillips (2011) encouraged researchers to investigate the Motivated Strategies for Learning Questionnaire (MSLQ) constructs in combination with other widely used determinants of academic achievement. Accordingly, we combine these constructs with educational productivity and we anticipate both direct effects of the MSLQ constructs and mediation by value, affect and expectancy (e.g. Pajares 1996).

Toward an extended educational productivity model

On the basis of the theoretical approaches and previous research we have outlined, we propose a conceptual model as shown in Figure 1. By testing this extended educational productivity model in a contemporary university context, we address three research questions:

(1) To what extent and how do the factors pertaining to the proposed extended productivity model relate to early study success?
(2) Do factors pertaining to the expectancy-value affect theory add value to educational productivity factors for explaining early study success?
(3) To what extent do the models for study success after the mid-term of the first semester differ from the model after the first semester?
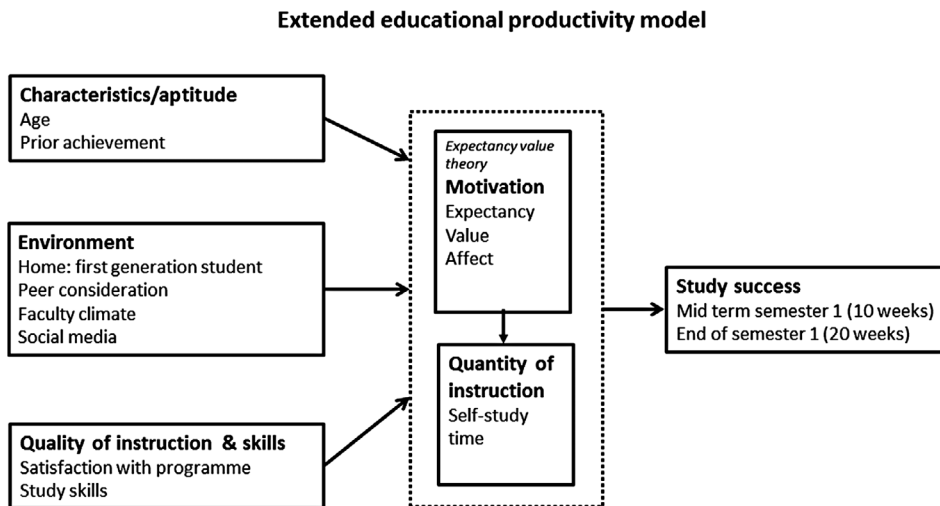
Extended educational productivity model

Figure 1. Schematic overview of the proposed conceptual education productivity model, as extended with expectancy-value theory.

Method

Participants

The participating students were recruited from the psychology, sociology, and pedagogical sciences bachelor's degree programmes at the Faculty of Behavioural and Social Sciences (BSS) of the University of Groningen. The University of Groningen is a research university in the north of the Netherlands with about 30,000 students in 2014. The sample consisted of 407 first-year social science bachelor's students (22% male, 78% female) with a mean age of 19.3 years (SD = 2.0), such that it was representative of the overall population of 589 first-year BSS students, i.e. 20% male and 80% female with a mean age of 20.0 years (SD = 2.0). From the psychology degree programme 243 students participated, from sociology 89 students, and from pedagogical sciences 75 students. The participants were predominantly Dutch (99%), living away from home (68%), and second-generation students (89%), such that at least one of their parents or siblings was highly educated. Most participants entered university with a pre-university diploma (N = 325, 81%), and a minority had attained another bachelor's degree (N = 66; 16%) or admission for university studies (N = 11; 3%).

Measures

We conducted two surveys reflecting the nine educational productivity factors, divided in the three groups of student characteristics and aptitude, environment, and instruction. The first asked about home environment, programme satisfaction, and time management (i.e. self-study, social media use). The second survey asked about motivation, peer environment, faculty environment, and study skills. The response rate for the first survey was approximately 69% (N = 407), that for the second measurement was 62% (N = 364), and the attrition rate was 11% (N = 43). Table 1 presents the items and structure of the scales, means (M), standard deviations (SD), and reliability (α). The Cronbach's alpha coefficients indicated good internal consistency for the scales, with a range from .70 to .82. Students responded on a scale from 1 ('strongly disagree') to 5 ('strongly agree').

Table 1. Means (M), standard deviations (SD), and internal consistency of the scales.

Educational productivity	Operationalisation factors	Items (n)	M	SD	α
Aptitude and characteristics					
Ability	Prior achievement	1	6.67	0.57	
Age	Age	1	19.34	1.98	
Motivation	Expectancy	9	3.50	0.42	.70
	Value	9	3.97	0.42	.77
	Affect	5	2.85	0.75	.77
Social-psychological environment					
Home	First-generation student (yes/no)	1	-	-	-
Educational	Faculty climate	8	3.80	0.48	.78
Peer group	Peer consideration	5	3.86	0.47	.75
Media	Social media	1	7.29	5.74	
Instruction					
Quantity	Time spent on self-study	1	16.64	7.97	
Quality	Satisfaction with programme	2	4.23	0.84	.82
	Study skills	10	3.37	0.58	.77
Outcome					
Learning	Success midpoint semester 1	1	6.77	1.13	
	Success end semester 1	1	6.42	1.43	

Information regarding *age* and *prior achievement* was obtained from the university's central administration. Prior achievement, as an indicator of ability and aptitude, was derived from the students' secondary Dutch central school exam grades in the following core subjects: Dutch language and literacy, English language and literacy, and mathematics. Using achievement in these subjects leads to similar results to those obtained from averaging performance on all exam subjects (Severiens et al. 2011). Therefore, we used the mean of these three subjects to indicate prior achievement. The exam grades were verified by the Dutch Ministry of Education (Dienst Uitvoering Onderwijs), obtained from the central administration of the University of Groningen.

Motivation was assessed by the widely used MSLQ (Pintrich et al. 1991), which reflects the affect-extended expectancy-value theory (Pintrich and de Groot 1990). Its motivation section comprises three scales: expectancy, value, and affect, with six subscales. The two *expectancy* subscales measure self-efficacy beliefs about learning and performance and control of learning beliefs, such as 'I am confident I can learn the basic concepts of a course'. The three *value* subscales measure task value, intrinsic goal orientation, and extrinsic goal orientation, such as 'I prefer study material that is challenging to me so I can learn new things'. *Affect* subscale measures anxiety using items such as 'When I take a test I think about how poorly I am doing compared to other students'.

Reflecting the educational productivity factors regarding home, peer and learning environment and media were operationalised in contemporary university context. Being a first-generation student was a dichotomous indicator of the *home environment*. A student was classified as a first-generation student if she or he indicated that neither parents nor siblings were highly educated. Eleven per cent of students did not have any highly educated family members. *Peer consideration* was the extent to which students were willing to interact with fellow students, in terms of collaboration, providing support, or listening. The scale was derived from the compassion and solidarity scales used by Boom and Pennink (2012) in an organisational context. An example item was 'I am willing to listen to my fellow students if they have problems'. *Faculty climate* measured the perceived atmosphere, related to other students, the mentor, or the study adviser. This scale was derived from Severiens, ten Dam, and Blom (2006). An example item read 'I like going to the faculty'. *Media* was indicated by the use of social media, measured with an open question about the number of hours participants spent using social media weekly.

Quantity of instruction was measured with an open question about the number of hours participants spent on self-study weekly. *Quality of instruction* was indicated by satisfaction with the programme. When students were satisfied, they seemingly appreciate, among other things, the instruction. It included, for example, 'I am happy with my choice of degree programme'. The item 'I'm thinking about starting another degree programme' was reverse coded, so higher scores had a positive connotation. The *study skills* scale came from the MSLQ's learning strategy scales. Learning strategies can be divided into cognitive and metacognitive strategies, such as rehearsal, organisation, elaboration, critical thinking, and meta-cognitive self-regulation, and resource management, such as time and study environments, effort regulation, peer learning, and help seeking. However, only one component emerged from an exploratory factor analysis in the current sample and included, for example, 'I make sure to keep up with the weekly readings and assignments for a course'. The item, 'I often feel so lazy or bored when I study for this class that I quit before I finish what I planned to do' was reverse coded, so that higher scores had a higher connotation.

As a continuous dependent variable, *early study success* was measured as a weighted average mark (WAM*i*). Grades were weighted by the obtained European credits (ECTS), divided by the maximum ECTS in the programme for the first two periods (i.e. at the midpoint of the first semester and after the first semester).With students' informed consent, students' academic records were obtained from the university at the end of the first semester, to ascertain students' grades.

Procedure

All first-year students in the BSS at University of Groningen were approached. During an introductory period, students were informed verbally about the aims, the procedure, and that the data will be processed anonymously. The students received written information and were asked for their informed consent to participate in the study and to use their centrally registered study results. Nineteen students were excluded, because they did not give informed consent to release their official university records. The study was approved by the ethical committees of the departments responsible for the degree programmes. The data were collected at the midpoint and at the end of the first semester, namely, in October 2013 and January 2014. Both surveys were provided to the students in Dutch. Participation was voluntary, and students could fill out the surveys at home (for pedagogical sciences) or at the faculty during a course (for psychology and sociology).

Statistical analyses

Path analysis, conducted in the statistical programme Mplus Version 7.2, was performed to test the proposed extended productivity model by including the observed variables expressed by the means of the underlying items of the scales. The model fit was evaluated with the following indices: the Chi-square test ($\chi 2$), comparative fit index (CFI), root mean square error of approximation (RMSEA), and standardised root mean square (SRMR). Indications of a good fit are a non-significant $\chi 2$-test, RMSEA values less than .06, SRMR at .08 or below, and CFI close to or greater than .95 (Hu and Bentler 1999; Kline 2011).

Few missing values remained for the study success dependent variable at the midpoint of the first semester (.5%) and after the first semester (0%). Little's (1988) MCAR test was significant, indicating that the data were not missing completely at random ($\chi 2(137) = 305.31$, $p < .001$). In total, the proportion of missing cases varied from .5% to 12.0%, which is quite small and assumed to be missing at random (MAR). That is, we can assume MAR, because the missing cases relate to the observed data, not the dependent variables (e.g., De Leeuw, Hox, and Huisman 2003; Little and Little and Rubin 2002). To handle MAR, maximum likelihood (ML) is appropriate, in that it handles missing data well while producing unbiased estimates (Allison 2002; Arbuckle 1996; McKnight et al. 2007). However, the data also indicate violations of multivariate normality. ML estimation with robust standard errors (MLR; Muthén and Muthén 1998-2012; see also Kline 2011) thus offers a good approach, because it can deal with MAR even when the multivariate normality assumption is violated.

Results

Correlation analyses

A bivariate correlation analysis was conducted to explore the relationships among the educational productivity factors, and the motivational factors (expectancy, value, and affect). In general, small positive and significant relationships emerged for the relationships with early study success, except for age and affect. Regarding the environment, peer support related only significantly to study success at the midpoint of the first semester ($r = .13$, $p < .05$). Furthermore, the time spent on self-study related positively to time spent on social media ($r = .10$, $p < .05$). We included the significant relationships with time spent on self-study, expectancy, value and affect to test their indirect effects. Because the home environment was not significantly related to the other factors, we excluded it from further analysis. Furthermore, study success at midpoint first semester and after the first semester were highly correlated ($r = .78$. $p \leq .001$). To disentangle the determinants of each of the two time points, we estimated separate models for both time points. With this, we prevented that most of the variance would be explained by a stability path in a longitudinal model, which would have masked the effects of the variables of theoretical interest. Table A1 in the Appendix provides more details.

Path modelling

We conducted path analyses to explore the hypothesised relationships among the factors in the proposed extended educational productivity model. The fit indices, obtained using MLR, revealed that the first model did not fit the data for study success at the midpoint of the first semester ($\chi^2(17)=113.36$; $p < .001$, CFI = .696, RMSEA = .133, SRMR = .056) or study success after the first semester ($\chi^2(7)=113.26$; $p < .001$, CFI = .727, RMSEA = .133, SRMR = .057). Following recommendations for model trimming, we modified the model by dropping the non-significant relationships. Through the model-building process defined by Kline (2011), we developed a final empirical model that optimally described the relationships among all variables. Next, we added the correlation between expectancy, value and affect, and as a third step, we tested the indirect effects on the basis of the significant relationships. Despite the complexity and the number of observed variables still included, these models fit the data very well for the study success at the midpoint of the first semester ($\chi^2(17) = 21.97$; $p \geq .05$, CFI = .985, RMSEA = .030 [.000;.062], SRMR = .034) and study success after the first semester ($\chi^2(17) = 21.79$; $p \geq .05$, CFI = .987, RMSEA = .029 [.00;.06], SRMR = .034).

Path model for study success at the midpoint of the first semester

Figure 2 contains a graphic depiction of the model for study success at the midpoint of the first semester. Using the standardised variables, we found significant relationships between study success and prior achievement, study skills, and expectancy. The indirect relationships between early study success at the midpoint of the first semester and age ($b^* = .02$, $p < .05$), peer consideration ($b^* = .03$, $p < .05$), and satisfaction with programme ($b^*= .03$, $p < .05$), were mediated by expectancy. This model explained significantly 19% of the variance in early study success at the midpoint of the first semester, 16% in time spent on self-study, 14% in expectancy and 22% in value.
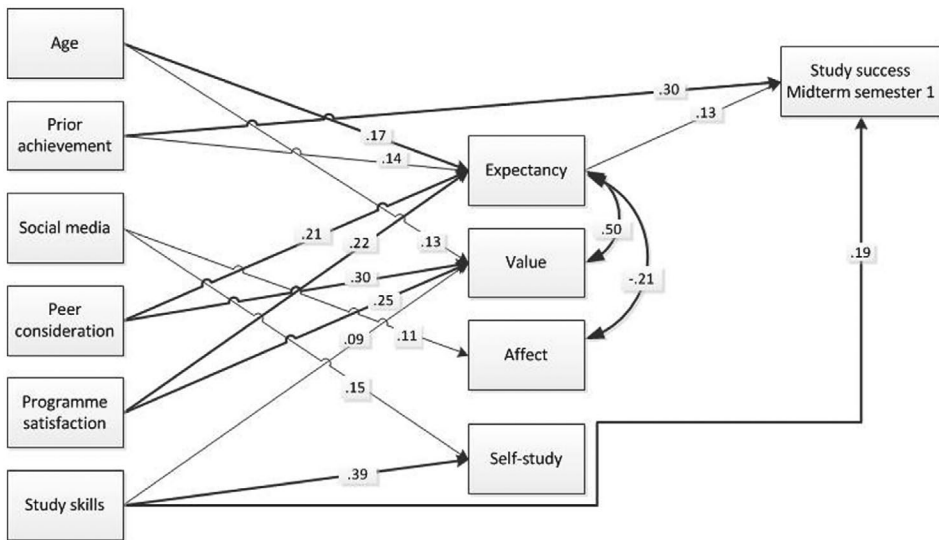
Figure 2. Model of the determinants of study success midterm semester.
Note: Significant (bold paths $p \leq .001$) and standardised coefficients of the extended educational productivity model and study success at the midpoint of the first semester are displayed.

Path model for study success after the first semester

Figure 3 offers a graphic depiction of the model for study success at the end of the first semester. Using the standardised variables, age was negatively related to study success, whereas prior achievement, time spent on self-study, satisfaction with the programme, study skills, and expectancy were positively related to study success. The indirect relationships between early study success after the first semester and age ($b* = .02$, $p < .05$), peer consideration ($b* = .03$, $p < .05$), and satisfaction with study programme ($b* = .03$, $p < .05$), were mediated by expectancy, and for study skills mediated by time spent on self-study ($b* = .04$, $p < .05$). This model explained significantly 30% of the variance in early study success after first semester, 16% in time spent on self-study, 14% in expectancy, and 22% in value.

Model comparisons

Compared with those for study success at the midpoint of the first semester, we found more significant direct relationships between the educational productivity factors on early study success after the first semester, which explained 11% more of the variance in study success. Relationships between early study success after the first semester emerged for age, time for self-study, and satisfaction with the programme; these relationships were non-significant with early study success at the midpoint of the first semester.

In addition to these differences, some consistencies emerged between the models. For the mid-term of the semester as well as at the end of the first semester, time spent on self-study was positively related to study skills and social media, which implies that students who spent more time on their studies and have more effective study skills spent more time on social media. Social media was also positively related to affect, suggesting that students use social media for reflecting their emotional concerns. For value and expectancy, positive relationships were found with age, peer consideration, and satisfaction with programme. Study skills were positively related to value, but the effect was small. Prior achievement
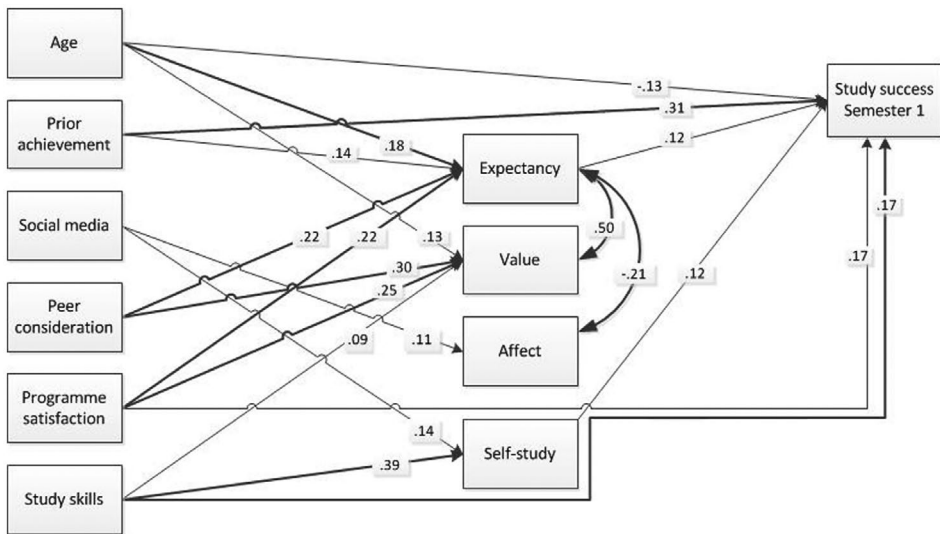
Figure 3. Model of the determinants of study success at the end of semester 1.
Note: Significant (bold paths $p \leq .001$) and standardised coefficients of the extended educational productivity model and study success after the end of the first semester are displayed.

contributed most in explaining study success, as well as indirectly through expectancy. It appeared that when students have obtained higher grades in high school, they believe more that they will succeed. Expectancy was important for explaining study success, because it mediated the relationships with several educational productivity factors. Value and affect did not mediate the relationship with the educational productivity factors and study success at the mid-term and after the first semester, but value was positively related to the expectancy, and affect was negatively related to expectancy. Overall, these results reveal the added value of the expectancy-value theory in addition to the educational productivity factors in one model for explaining early study success.

Discussion and conclusions

Increasing enrolment in university programmes, and the concomitant poor progress of first-year university students, inspired the present study. We aimed to improve understanding of first-years students' early study success, at the midpoint of the first semester and after the first semester. We adopted a theoretical framework to conceptualise educational productivity factors in the contemporary university context and extend them with factors derived from adapted versions of expectancy-value theory.

The findings largely support the schematic presentation of the conceptual extended educational productivity model in Figure 1. Our path analysis reveals that early study success across the first semester related, either directly or indirectly, to the educational productivity factors age, prior achievement (ability), psychosocial environment (peer consideration, faculty climate, and social media use), quantity of instruction (time spent on self-study), and quality of instruction (satisfaction with the programme, study skills); and an achievement motivation, in the form of expectancy, which was correlated with value and affect. Expectancy was an important mediator of the relationship with the educational productivity factors. These findings confirm the expectation that factors in our extended educational

productivity model are important determinants of early study success and supported partly our expectation that expectancy, value, and affect would have added value, beyond the educational productivity model, for explaining early study success.

In line with previous studies, prior achievement was the most important determinant of study success in the first semester (e.g. Bruinsma and Jansen 2007; McKenzie, Gow, and Schweitzer 2004). Counter-intuitively, the more time students spend on social media, the more time they spend on self-study. It, thus, appears that students use social media for self-study, such as asking study-related questions on social media platforms and to motivate each other. Price and Kadi-Hanifi (2011) found, indeed, that students use social media to keep motivated for studying, which is also in line with our finding of the positive relationship between social media and affect. Also consistent with previous studies in a Dutch university context (Van den Berg and Hofman 2005; Bruinsma and Jansen 2007), we did not find an effect of the home environment, measured as parents' or siblings' educational level. This may be the result of the uneven distribution of students with highly educated kin in the representative sample of first-year students. Nor did we find direct effects of affect or value. In contrast, McKenzie, Gow, and Schweitzer (2004) indicate that internal locus of control (affect) and task value are important predictors of self-regulatory learning strategies and study success in the first semester. Our inability to find impacts of value and affect on study success might result from perceptions of these motivational factors as subject-related, rather than generic (Tempelaar et al. 2007). For example, students may be more nervous about a statistics exam than about theoretical tests, and also value the subjects in different ways.

More determinants explained study success after the first semester than at the midpoint of the first semester. Age, time spent on self-study and satisfaction with the programme were determinants of study success only after the first semester, not at the midpoint of the first semester. During an academic year, courses become more difficult, and the demands on students increase. Therefore, their background characteristics, behaviours, including time spent on self-study, may become more prominent, and individual differences among students will emerge. Students also develop a better idea of their studies and how satisfied they are with the programme. Furthermore, during the first semester, courses are changing from a general introduction to more specific course content and it may be that the self-study time becomes more important when courses are more specific and possibly more difficult. This is consistent with the finding that the relationship between self-study time on study success depends on the courses (Masui et al. 2014).

To conclude, we have evaluated the proposed extended educational productivity model and found that different factors pertaining to the original educational productivity model and expectancy-value theory explain early study success in a contemporary university context. The results are important not only for research into ways to enhance study success but also for theory about the added value of combining expectancy, value, and affect with original educational productivity factors. The empirical findings obtained on the basis of these theoretical orientations can be used to track early students and thus improve their study success rates.

Practical implications

It is important to monitor students at the very beginning of the academic year, because study failure can lead to a downward spiral of a low self-esteem, discouragement, or depression

(Reichart 2007; Wigfield, Byrnes, and Eccles 2006). Early tracking and intervention may help improve university students' performance. Our findings indicate that universities should pay attention not only to individual characteristics but also to the psychosocial environment of their degree programmes to enhance early study success. Universities need to provide a psychosocial environment that meets students' needs by stimulating peer consideration, improving the faculty climate, fitting instruction to their needs, and emphasising the importance of time spent on self-study. To adapt the psychosocial environment to the needs of students, universities might implement small-scale teaching, such as learning communities (LCs). A range of LC forms are available (Zhao and Kuh 2004), but a common factor involves stable groups of students with a mentor, who monitors the students' study progress and gives feedback on their learning process (Russell 2009; University of Groningen 2012). This mentor can use the current findings of which factors that contribute to early study success. Universities also can use these findings as practical guidelines for monitoring procedures, which should consider age, prior achievement, and achievement motivation. With such information, universities can develop assessments of the types of students who are most likely to succeed and track students more effectively at early stages. Preventive failure measures can be applied at the moment deficiencies are identified, such as a low score on expectancy scales or difficulties with time management. These recommendations are in line with recent studies (Doménech-Betoret, Gómez-Artiga, and Lloret-Segura 2014; Pawlowska et al. 2014). Degree programme satisfaction is another important predictor of early study success, which suggests the need to evaluate degree programmes to ensure they meet the needs of the diverse student population and enhance study success. More research is needed to specify monitoring procedures and programmes for tailored support.

Limitations and further research

The results of the path analyses, with a representative sample of students, are solid, but some limitations and suggestions for research also should be mentioned. First, we measured self-reports; the measurement might be improved if students recorded the time they spent on activities during the day, rather than retrospectively estimating an average for one week (e.g. Bolger, Davis, and Rafaeli 2003). In addition to time management, students' self-reports might describe other factors, such as achievement motivation, study skills, satisfaction with the study programme, interaction with peers, and leisure versus study-related uses of social media. Self-reports in conjunction with qualitative research would provide better insights into fluctuations in these variables over time. Second, our study was cross-sectional; a longitudinal design could shed more light on the temporal order of events and fluctuations in behaviours, attitudes, beliefs, and motivations. Third, we tested several theory-driven hypotheses, but we did not test for causality or offer a complete model of study success. The extended educational productivity model represents a template, and further replications of this study that explore additional relationships and constructs are necessary.

Disclosure statement

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References

Allison, P. D. 2002. *Missing Data*. Thousand Oaks, CA: SAGE Publications.

Arbuckle, J. L. 1996. "Full Information Estimation in the Presence of Incomplete Data." In *Advanced Structural Equation Modeling: Issues and Techniques*, edited by G. A. Marcoulides and R. E. Schumacker, 243–277. Mahwah, NJ: Erlbaum.

Arnett, J. J. 2004. *Emerging Adulthood: The Winding Road from the Late Teens through the Twenties*. New York: Oxford University Press.

Beerkens-Soo, M., and H. Vossensteyn. 2009. *Higher Education Issues and Trends from an International Perspective. Report Prepared for the Veerman Committee*. Enschede: Center for Higher Education Policy Studies. http://www.highereducation.si/wp-content/uploads/2012/08/Masifikacija-točka-2.pdf.

Bolger, N., A. Davis, and E. Rafaeli. 2003. "Diary Methods: Capturing Life as It is Lived." *Annual Review of Psychology* 54 (1): 579–616. doi:10.1146/annurev.psych.54.101601.145030.

Boom, I. H., and B. W. Pennink. 2012. "The Relationship between Humanness and Knowledge Sharing in Malaysia Empirical Evidence from Malaysian Managers." *Gadjah Mada International Journal of Business* 14 (2): 99–122.

Bruinsma, M., and E. P. W. A. Jansen. 2007. "Educational Productivity in Higher Education: An Examination of Part of the Walberg Educational Productivity Model." *School Effectiveness and School Improvement* 18 (1): 45–65. doi:10.1080/09243450600797711.

Charlton, J. P., C. Barrow, and P. Hornby-Atkinson. 2006. "Attempting to Predict Withdrawal from Higher Education Using Demographic, Psychological and Educational Measures." *Research in Post-Compulsory Education* 11 (1): 31–47. doi:10.1080/13596740500507904.

Christie, H., L. Tett, V. E. Cree, J. Hounsell, and V. McCune. 2008. "A Real Rollercoaster of Confidence and Emotions: Learning to Be a University Student." *Studies in Higher Education* 33 (5): 567–581. doi:10.1080/03075070802373040.

Credé, M., and L. A. Phillips. 2011. "A Meta-Analytic Review of the Motivated Strategies for Learning Questionnaire." *Learning and Individual Differences* 21 (4): 337–346. doi:10.1016/j.lindif.2011.03.002.

De Clercq, M., B. Galand, S. Dupont, and M. Frenay. 2013. "Achievement among First-Year University Students: An Integrated and Contextualised Approach." *European Journal of Psychology of Education* 28 (3): 641–662. doi:10.1007/s10212-012-0133-6.

De Leeuw, E. D., J. Hox, and M. Huisman. 2003. "Prevention and Treatment of Item Nonresponse." *Journal of Official Statistics* 19 (2): 153–176.

Dias, D., and M. J. Sá. 2012. "From High School to University: Students' Competences Recycled." *Research in Post-Compulsory Education* 17 (3): 277–291. doi:10.1080/13596748.2012.700094.

Doménech-Betoret, F., A. Gómez-Artiga, and S. Lloret-Segura. 2014. "Personal Variables, Motivation and Avoidance Learning Strategies in Undergraduate Students." *Learning and Individual Differences* 35: 122–129. doi:10.1016/j.lindif.2014.06.007.

Dutch Inspectorate of Education. 2014. "The State of Education in the Netherlands: Education Report 2012-2013." Utrecht, The Netherlands. http://www.onderwijsinspectie.nl/binaries/content/assets/Onderwijsverslagen/2014/onderwijsverslag-2012-2013.pdf.

Eccles, J. S., T. F. Adler, R. Futterman, S. B. Goff, C. M. Kaczala, J. L. Meece, and C. Midgley. 1983. "Expectancies, Values and Academic Behaviors." In *Achievement and Achievement Motivation*, edited by J. T. Spence, 75–146. San Francisco, CA: Freeman, W. H.

Etcheverry, E., R. A. Clifton, and L. W. Roberts. 2001. "Social Capital and Educational Attainment: A Study of Undergraduates in a Faculty of Education." *Alberta Journal of Educational Research* 47 (1): 24–39.

Fraser, B. J., H. J. Walberg, W. W. Welch, and J. A. Hattie. 1987. "Syntheses of Educational Productivity Research." *International Journal of Educational Research* 11: 147–252. doi:10.1016/0883-0355(87)90035-8.

George, D., S. Dixon, E. Stansal, S. L. Gelb, and T. Pheri. 2008. "Time Diary and Questionnaire Assessment of Factors Associated with Academic and Personal Success among University Undergraduates." *Journal of American College Health* 56 (6): 706–715. doi:10.3200/JACH.56.6.706-715.

Hattie, J. A. C. 2009. *Visible Learning: A Synthesis of over 800 Meta-Analyses Relating to Achievement.* London: Routledge.

Hu, L.-t., and P. M. Bentler. 1999. "Cutoff Criteria for Fit Indexes in Covariance Structure Analysis: Conventional Criteria versus New Alternatives." *Structural Equation Modeling: A Multidisciplinary Journal* 6 (1): 1–55. doi:10.1080/10705519909540118.

Ishitani, T. T. 2006. "Studying Attrition and Degree Completion Behavior among First-Generation College Students in the United States." *The Journal of Higher Education* 77 (5): 861–885. doi:10.1353/jhe.2006.0042.

Jansen, E. P. W. A., and M. Bruinsma. 2005. "Explaining Achievement in Higher Education." *Educational Research and Evaluation* 11 (3): 235–252. doi:10.1080/13803610500101173.

Kline, R. B. 2011. *Principles and Practice of Structural Equation Modeling.* 3rd ed. New York: Guilford Publications.

Little, R. J. A, and B. D. Rubin. 2002. *Statistical Analysis with Missing Data. Wiley Series in Probability and Mathematical Statistics.* Second Edition. New Yersey: John Wiley & Sons, Inc.

Masui, C., J. Broeckmans, S. Doumen, A. Groenen, and G. Molenberghs. 2014. "Do Diligent Students Perform Better? Complex Relations between Student and Course Characteristics, Study Time, and Academic Performance in Higher Education." *Studies in Higher Education* 39 (4): 621–643. doi:10.1080/03075079.2012.721350.

McIlroy, D., and B. Bunting. 2002. "Personality, Behavior, and Academic Achievement: Principles for Educators to Inculcate and Students to Model." *Contemporary Educational Psychology* 27 (2): 326–337. doi:10.1006/ceps.2001.1086.

McKenzie, K., and R. Schweitzer. 2001. "Who Succeeds at University? Factors Predicting Academic Performance in First Year Australian University Students." *Higher Education Research & Development* 20 (1): 21–33. doi:10.1080/07924360120043621.

McKenzie, K., K. Gow, and R. Schweitzer. 2004. "Exploring First-Year Academic Achievement through Structural Equation Modelling." *Higher Education Research & Development* 23 (1): 95–112. doi:10.1080/0729436032000168513.

McKnight, P. E., K. M. McKnight, S. Sidani, and A. J. Figueredo. 2007. *Missing Data: A Gentle Introduction*. New York: The Guilford Press.

Muthén, L. K., and B. O. Muthén. 1998-2012. *Mplus User ' s Guide*. 7th ed. Los Angeles, CA: Muthén & Muthén. https://www.statmodel.com/download/usersguide/MplususerguideVer_7_r3_web.pdf.

Pajares, F. 1996. "Self-Efficacy Beliefs in Academic Settings." *Review of Educational Research* 66 (4): 543–578. doi:10.3102/00346543066004543.

Pawlowska, D. K., J. W. Westerman, S. M. Bergman, and T. J. Huelsman. 2014. "Student Personality, Classroom Environment, and Student Outcomes: A Person–Environment Fit Analysis." *Learning and Individual Differences* 36: 180–193. doi:10.1016/j.lindif.2014.10.005.

Pellizzari, M., and F. C. Billari. 2012. "The Younger, the Better? Age-Related Differences in Academic Performance at University." *Journal of Population Economics* 25 (2): 697–739. doi:10.1007/s00148-011-0379-3.

Pintrich, P. R., and E. V. de Groot. 1990. "Motivational and Self-Regulated Learning Components of Classroom Academic Performance." *Journal of Educational Psychology* 82 (1): 33–40. doi:10.1037/0022-0663.82.1.33.

Pintrich, P. R., D. A. F. Smith, T. Garcia, and W. J. McKenzie. 1991. *A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ)*. Ann Arbor, MI: National Center for Research to Improve Postsecondary Teaching and Learning.

Plant, E., K. Ashby, A. Ericsson, L. Hill, and K. Asberg. 2005. "Why Study Time Does Not Predict Grade Point Average across College Students: Implications of Deliberate Practice for Academic Performance." *Contemporary Educational Psychology* 30 (1): 96–116. doi:10.1016/j.cedpsych.2004.06.001.

Price, F., and K. Kadi-Hanifi. 2011. "E-Motivation! the Role of Popular Technology in Student Motivation and Retention." *Research in Post-Compulsory Education* 16 (2): 173–187. doi:10.1080/13596748.2011.575278.

Reichart, C. G. 2007. "Depressie En Dysthymie [Depression and Dysthymia]." In *Kinder- En Jeugdpsychiatrie: Psychopathologie*, edited by F. C. Verhulst, F. Verheij, and R. F. Ferdinand, 348–363. Assen: Van Gorcum BV.

Reynolds, A. J., and H. J. Walberg. 1991. "A Structural Model of Science Achievement." *Journal of Educational Psychology* 83 (1): 97–107. doi:10.1037/0022-0663.83.1.97.

Reynolds, A. J., and H. J. Walberg. 1992. "A Structural Model of Science Achievement and Attitude: An Extension to High School." *Journal of Educational Psychology* 84 (3): 371–382.

Richardson, M., C. Abraham, and R. Bond. 2012. "Psychological Correlates of University Students' Academic Performance: A Systematic Review and Meta-Analysis." *Psychological Bulletin* 138 (2): 353–387. doi:10.1037/a0026838.

Robbins, S. B., K. Lauver, H. Le, D. Davis, R. Langley, and A. Carlstrom. 2004. "Do Psychosocial and Study Skill Factors Predict College Outcomes? A Meta-Analysis." *Psychological Bulletin* 130 (2): 261–288. doi:10.1037/0033-2909.130.2.261.

Russell, M. 2009. "Towards More Confident Learners: The Use of Academic Mentors with Foundation Degree Students." *Research in Post-Compulsory Education* 14 (1): 57–74. doi:10.1080/13596740902717416.

Severiens, S., G. ten Dam, and S. Blom. 2006. "Comparison of Dutch Ethnic Minority and Majority Engineering Students: Social and Academic Integration." *International Journal of Inclusive Education* 10 (1): 75–89. doi:10.1080/13603110500221651.

Severiens, S., B. de Koning, S. Loyens, M. Torenbeek, C. Suhre, E. Jansen, M. Bruinsma, M. Meeuwisse, and P. van Wensveen. 2011. *Studiesucces in de Bachelor: Drie Onderzoeken Naar Factoren Die Studiesucces in de Bachelor Verklaren* [Study Success in Undergraduate Education: Three Explanatory Studies]. The Hague, The Netherlands: Ministry of Education, Culture and Science.

Sheard, M. 2009. "Hardiness Commitment, Gender, and Age Differentiate University Academic Performance." *The British Journal of Educational Psychology* 79 (1): 189–204. doi:10.1348/000709908X304406.

Stage, F. K., and D. Hossler. 2000. "Where is the Student? Linking Student Behaviors, College Choice, and College Persistence." In *Reworking the Student Departure Puzzle*, edited by J. M. Braxton, 170–195. Nashville, TN: Vanderbilt University Press.

Stegers-Jager, K., and J. Cohen-Schotanus. 2012. "Effect van Dreiging van Een Negatief Bindend Studieadvies Op de Studievoortgang [Effect of Threat of Dismissal on Study Progress]." In *Studiesucces Bevorderen: Het Kan en Is Niet Moeilijk* [Enhancing Study Success: It Can but Should Not Be Difficult. Evidence of Performance Improvements in Higher Education], edited by H. Van Berkel, E. Jansen, and A. Bax, 89–101. The Hague: Boom Lemma.

Suhre, C. J. M., E. P. W. A. Jansen, and E. G. Harskamp. 2007. "Impact of Degree Program Satisfaction on the Persistence of College Students." *Higher Education* 54 (2): 207–226. doi:10.1007/sl0734-005-2376-5.

Svanum, S., and S. M. Bigatti. 2006. "The Influences of Course Effort and outside Activities on Grades in a College Course." *Journal of College Student Development* 47 (5): 564–576. doi:10.1353/csd.2006.0063.

Tempelaar, D. T., W. H. Gijselaers, S. Schim van der Loeff and J. F. H. Nijhuis. 2007. "A Structural Equation Model Analyzing the Relationship of Student Achievement Motivations and Personality Factors in a Range of Academic Subject-Matter Areas." *Contemporary Educational Psychology* 32 (1): 105–131. doi:10.1016/j.cedpsych.2006.10.004.

Torenbeek, M. 2011. "Hop, Skip and Jump? The Fit between Secondary School and University." PhD diss., University of Groningen, Groningen, The Netherlands.

Torenbeek, M., E. Jansen, and A. Hofman. 2010. "The Effect of the Fit between Secondary and University Education on First-Year Student Achievement." *Studies in Higher Education* 35 (6): 659–675. doi:10.1080/03075070903222625.

University of Groningen. 2012. *Profileringsdocument En Prestatieafspraken Rijksuniversiteit Groningen* [Document Profiling and Performance Agreements, University of Groningen]. Groningen, The Netherlands: University of Groningen.

Van den Berg, M. N., and W. H. A. Hofman. 2005. "Student Success in University Education: A Multi-Measurement Study of the Impact of Student and Faculty Factors on Study Progress." *Higher Education* 50 (3): 413–446.

Walberg, H. J. 1984. "Improving the Productivity of America's Schools." *Educational Leadership* 41 (8): 19–27.

Walberg, H. J. 1986. "Synthesis of Research on Teaching." In *Handbook of Research on Teaching*, edited by M. C. Wittrock, 214–229. Washington, DC: American Educational Research Association.

Wigfield, A., and J. S. Eccles. 1992. "The Development of Achievement Task Values: A Theoretical Analysis." *Developmental Review* 12 (3): 265–310. doi:10.1016/0273-2297(92)90011-P.

Wigfield, A., J. P. Byrnes, and J. S. Eccles. 2006. "Development during Early and Middle Adolescence." In *Handbook of Educational Psychology*, edited by P. A. Alexander and P. H. Winne, 61–113. New York: Routledge.

Zepke, N., L. Leach, and T. Prebble. 2006. "Being Learner Centred: One Way to Improve Student Retention?" *Studies in Higher Education* 31 (5): 587–600. doi:10.1080/03075070600923418.

Zhao, C.-M., and G. D. Kuh. 2004. "Adding Value: Learning Communities and Student Engagement." *Research in Higher Education* 45 (2): 115–138. doi:10.1023/B:RIHE.0000015692.88534.de.

Appendix

Table A1. Bivariate correlations.

	Age	Prior achievement	Expectancy	Value	Affect	Home[1]	Peer consideration	Faculty climate	Social media	Self-study	Satisfaction with program	Study skills	Study success midpoint semester 1	Study success end semester 1
Age	1.00													
Prior achievement	–.23**	1.00												
Expectancy	.14*	.16*	1.00											
Value	.14*	.09	.59**	1.00										
Affect	–.01	–.05	–.24**	–.10	1.00									
Home[1]	.07	–.01	–.03	.07	–.05	1.00								
Peer consideration	–.05	–.06	.26**	.35**	–.02	.04	1.00							
Faculty climate	–.04	–.13*	.18**	.26**	.03	.07	.57**	1.00						
Social media	–.09	–.02	–.11*	–.07	.13*	–.02	.00	.03	1.00					
Self-study	–.07	.10	–.02	.04	–.03	.10	.01	.07	.10*	1.00				
Satisfaction with programme	.08	.08	.31**	.36**	–.11*	.03	.19**	.24**	–.02	.11*	1.00			
Study skills	–.06	.09	.13*	.23**	–.02	.10	.21**	.30**	–.07	.37**	.28**	1.00		
Study success mid-point first semester	.00	.35**	.20**	.14*	–.13*	.08	.13*	.03	–.07	.17**	.17*	.25**	1.00	
Study success first semester	–.12*	.39**	.21**	.15*	–.12*	.05	.07	–.01	.–.06	.24**	.28**	.31**	.78**	1.00

Note: Home (first-generation student) is a dichotomous variable; non-parametric correlations (Spearman's rho) between home and the other variables are displayed.
**$p \le .001$. *$p \le .05$.