

EUR Research Information Portal

Effects of participation in excellence programmes on cognitive and non-cognitive skills among higher education students in the Netherlands

Published in:

European Journal of Higher Education

Publication status and date:

Published: 01/01/2021

DOI (link to publisher):

[10.1080/21568235.2020.1850315](https://doi.org/10.1080/21568235.2020.1850315)

Document Version

Publisher's PDF, also known as Version of record

Document License/Available under:

CC BY

Citation for the published version (APA):

Jacobs, M., Huijts, T., van Broekhoven, K., Straetmans, S., Meng, C., & van der Velden, R. (2021). Effects of participation in excellence programmes on cognitive and non-cognitive skills among higher education students in the Netherlands. *European Journal of Higher Education*, 11(1), 44-63. <https://doi.org/10.1080/21568235.2020.1850315>

[Link to publication on the EUR Research Information Portal](#)

Terms and Conditions of Use

Except as permitted by the applicable copyright law, you may not reproduce or make this material available to any third party without the prior written permission from the copyright holder(s). Copyright law allows the following uses of this material without prior permission:

- you may download, save and print a copy of this material for your personal use only;
- you may share the EUR portal link to this material.

In case the material is published with an open access license (e.g. a Creative Commons (CC) license), other uses may be allowed. Please check the terms and conditions of the specific license.

Take-down policy

If you believe that this material infringes your copyright and/or any other intellectual property rights, you may request its removal by contacting us at the following email address: openaccess.library@eur.nl. Please provide us with all the relevant information, including the reasons why you believe any of your rights have been infringed. In case of a legitimate complaint, we will make the material inaccessible and/or remove it from the website.



Effects of participation in excellence programmes on cognitive and non-cognitive skills among higher education students in the Netherlands

Madelon Jacobs, Tim Huijts, Kim van Broekhoven, Stefan Straetmans, Christoph Meng & Rolf van der Velden

To cite this article: Madelon Jacobs, Tim Huijts, Kim van Broekhoven, Stefan Straetmans, Christoph Meng & Rolf van der Velden (2021) Effects of participation in excellence programmes on cognitive and non-cognitive skills among higher education students in the Netherlands, European Journal of Higher Education, 11:1, 44-63, DOI: [10.1080/21568235.2020.1850315](https://doi.org/10.1080/21568235.2020.1850315)

To link to this article: <https://doi.org/10.1080/21568235.2020.1850315>



© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group



[View supplementary material](#)



Published online: 02 Dec 2020.



[Submit your article to this journal](#)



Article views: 1255






[View related articles](#)



[View Crossmark data](#)

Effects of participation in excellence programmes on cognitive and non-cognitive skills among higher education students in the Netherlands

Madelon Jacobs ^a, Tim Huijts ^a, Kim van Broekhoven ^a, Stefan Straetmans ^b, Christoph Meng ^a and Rolf van der Velden ^a

^aResearch Centre for Education and the Labour Market (ROA), School of Business and Economics, Maastricht University, Maastricht, The Netherlands; ^bDepartment of Finance, School of Business and Economics, Maastricht University, Maastricht, The Netherlands

ABSTRACT

Most existing studies on excellence programmes focus primarily on the characteristics of students and/or programmes. However, little is known about the effects of participation in excellence programmes on cognitive and non-cognitive outcome measures. This study uses longitudinal data on over 1,000 students from five higher education institutions in the Netherlands to examine the added value of the excellence programmes relative to the regular education programmes. This study contributes to the current literature on the effects of participation in excellence programmes in three ways: the use of a representative control group; investigating multiple cognitive and non-cognitive outcome measures; and longitudinal assessments over a period of two years with pre- and post-test measurements (i.e. at the start and the end of the excellence programme). Our findings suggest that students who participated in excellence programmes have developed positively on both cognitive and non-cognitive skills, but that their development was not substantially different compared to students who did not participate in excellence programmes. The results underline that the students who participated in excellence programmes already performed better on most cognitive and non-cognitive skill measures at the start of the programme compared to students who did not participate in excellence programmes.

ARTICLE HISTORY

Received 5 November 2020
Accepted 9 November 2020


KEYWORDS

Excellence programmes;
Higher education; Skills;
Longitudinal data

Introduction

Over the past twenty years, excellence programmes have been established and implemented at almost all higher education institutions in the Netherlands. Through the so-called Sirius subsidy in 2008, the Dutch government invested €61 million euros to further expand and stimulate excellence programmes in various institutions. In

CONTACT Tim Huijts  t.huijts@maastrichtuniversity.nl  Research Centre for Education and the Labour Market, School of Business and Economics, Maastricht University, P.O. Box 616, Maastricht, MD 6200, The Netherlands

 Supplemental data for this article can be accessed <https://doi.org/10.1080/21568235.2020.1850315>

© 2020 The Author(s). Published by Informa UK Limited, trading as Taylor & Francis Group

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

general, excellence programmes in the Netherlands are set up to complement the regular education programmes (Kool et al. 2017). Although traditionally higher education in the Netherlands is geared towards promoting inclusivity and equality, in the last two decades additional curricula and programmes were developed for excellent students who are eager to pursue opportunities to further broaden and deepen their learning beyond their regular education programmes (Wolfensberger, van Eijl, and Pilot 2004).

Nevertheless, although the number and popularity of excellence programmes have grown substantially, little is known about the potential benefits of excellence programmes for students in the Netherlands. First, despite research on the effects of excellence programmes has expanded significantly in recent years (Dai, Swanson, and Cheng 2011), the majority of the academic literature in this field stems from the United States where excellence education (e.g. Gifted and Talented Programs) has a much longer history (see e.g. Davis and Rimm 1989). Moreover, the scope and content of excellence education in the United States (and of higher education more generally) is not directly comparable to the Netherlands, which makes it difficult to generalise the results from earlier research on the United States to excellence programmes in the Netherlands. Second, it is a challenging task to assess the effects of participation in excellence education. Most previous studies did not follow the students in a longitudinal manner and focused mostly on grades as indicators of cognitive development, ignoring non-cognitive skills and other measures of cognitive development (Allen et al. 2015; Scager et al. 2012). Moreover, the students who participate in excellence programmes are usually a selective group, because most excellence programmes in the Netherlands aim to only admit excellent students with above-average grades and high motivation for participation (see also the other paper by Jacobs et al. (forthcoming) in this special issue). This eligibility requirement makes it difficult to find a suitable control group of students in regular programmes, which is essential to assess the added value of participation in excellence programmes. In one of the few articles examining the effects of excellence programmes in the Netherlands, Kool et al. (2017) include measures of motivation, creativity, and ability to assess students' development. This study revealed that students' development halfway through the excellence programme does not differ compared to students in regular programmes. Although this study contributed significantly to the literature by including both cognitive and non-cognitive outcome measures and by following students longitudinally, the number of respondents included was relatively limited ($N = 94$) and covered only one higher education institution in the Netherlands.

This paper aims to examine the effects of participation in excellence programmes on various cognitive and non-cognitive skills among higher education students in the Netherlands. To this end, we collected longitudinal data on 1,049 students from five higher education institutions in the Netherlands over the period 2016–2019. The current study contributes to existing knowledge and addresses the limitations of previous studies in three ways. First, this study includes measures of several cognitive and non-cognitive skills to assess students' development during their participation in the excellence programmes. After all, excellence programmes do not only aim to develop cognitive skills, but also a range of non-cognitive skills (Hernández-Torrano and Saranlı 2015). Therefore, alongside measures of academic performance, this study includes measures of creativity, critical thinking, leadership, and political engagement, all of which have been identified in previous research as being central to the core objectives of excellence

education (Renzulli 2002). Second, this study assesses students' development using a longitudinal approach in which students completed questionnaires and tests both at the start and at the end of the excellence programmes. Thirdly, in our control group of students who did not participate in excellence programmes, in one of our robustness checks we are able to distinguish between students in the regular programmes who were not eligible for participation in excellence programmes, and students in the regular programmes who were eligible for participation in excellence programmes but for various reasons did not participate in these programmes. These students are eligible to participate in the excellence programmes, and are therefore relatively similar to students who do participate in excellence programmes. The current study aims to answer the following research question: *What are the effects of participation in excellence programmes on cognitive and non-cognitive skills among higher education students in the Netherlands?*

Development of cognitive and non-cognitive skills in excellence programmes: theoretical explanations and mechanisms

In this section, we describe how participation in excellence programmes could potentially be beneficial for students' cognitive and non-cognitive development in higher education. To this end, it is important to understand the main visions and aims underlying the excellence programmes in the Netherlands. Excellence education in the Netherlands was shaped by combining three different visions on excellence (Allen et al. 2015). The first is 'talent development': each excellence programme offers education in which all students can perform optimally, regardless of how talented they are. The second vision on excellence is 'excellent education for excellent students', with the main focus on educating students who have proven to be more talented and motivated compared to other students. This implies that (at least to some extent) excellence programmes would need to be tailored to optimise the further development of this specific group of excellent students. The third vision is 'excellence as innovation', where motivated students are given the freedom to follow education outside of the regular curriculum. This allows the students to broaden their knowledge which in turn allows institutions to experiment with new ways of teaching and new visions on learning.

In line with Bhatt's (2009) definition of excellence education, excellence programmes can be organised and structured in a variety of ways, and the intended learning outcomes differ considerably between institutions, and even between excellence programmes within the same institution. After all, although most excellence programmes aim to combine and balance all three visions on excellence, there is an obvious tension between the three visions when it comes to their practical implications for the organisation of the excellence programmes, and programmes vary in which vision is emphasised most strongly. Regardless of how diverse excellence programmes may be, excellence programmes in the Netherlands do share a number of common elements. They are all designed to accommodate and encourage students who indicate that they would like to broaden and deepen their learning beyond their regular programmes. Generally, the extra tuition that is offered in excellence programmes differs in various ways from regular teaching programmes. Another common feature of excellence programmes is that achieving high grades is usually not among the key objectives, and the focus is rather on broad skill development (Hernández-Torrano and Saranlı 2015). In this light, it is surprising that the literature on the

effects of participation in excellence programmes has largely focused on obtained grades, whereas other skills that excellence programmes emphasise (such as critical thinking and creativity; see e.g. Renzulli 2002) are often ignored.

Additionally, in its strategic agenda for higher education, the Dutch Ministry of Education, Culture and Science (2011) included a specific section on excellence programmes in which it indicated that the Ministry sees excellence programmes as a means of preparing students to become 'potential leaders'. Scientific literature on the topic also underlines that the development of leadership skills is often covered in excellence programmes. For example, Subotnik, Olszewisku-Kubulius and Worrel (2011) argue that excellence programmes are ideally suited to train future innovators, creative thinkers, and young leaders. As such, excellence programmes aim to assist students in developing essential skills for the twenty-first century (Heijltjes 2014), and to train students to become successful professionals (Scager et al. 2012). Research by Kautz et al. (2014) shows that all the above-mentioned skills are important indicators for later labour market competencies. They emphasise that practicing these skills at a young age has positive consequences for students' results in higher education, but also for their success in the labour market and in society more generally.

Given that the development of a broad range of skills is central to the aims of excellence programmes, it is important to consider how excellence programmes effectively promote and enhance the development of these skills. The main theoretical explanation for the additional development that students experience through their participation in excellence programmes is provided by human capital theory (Becker 1962). This theory argues that the development of human capital is based on repeated practice of skills. In other words, the more time spent on a particular skill, the more proficient a person becomes in this skill. Training and education play an important role in the development of cognitive and non-cognitive skills (Becker 1962), and these skills constitute important sources of human capital in the further trajectories and future success of students on the labour market.

Hernández-Torrano and Saranlı (2015) have applied this theory specifically to excellence programmes and argue that these programmes focus on the development of human and social capital. In order to do so, excellence programmes have a dual purpose: they aim to help students in developing to the best of their ability, and they aim to train future leaders who will be able to address the current complex problems in society. Human capital, and investing in human capital, ensures that students invest in their own future through education. On the one hand, excellence programmes offer students more teaching time, which is used to further develop skills that are already covered in the regular education programmes, but on the other hand they also provide additional courses and training to develop skills that are not or less explicitly offered in the regular programmes. Taken together, this gives students in excellence programmes additional opportunities to develop skills during their educational career which they can apply in their transition to the labour market. This mechanism could explain how students in excellence programmes could benefit from this additional investment in education, depending on the extent to which excellence programmes use effective strategies to develop and promote human capital, such as promoting a wide variety of skills (Kautz et al. 2014). Also, student development in excellence programmes partly depends on students' personal characteristics (Gagné 2000), such as motivation, personality traits, and

perseverance. When a student has these qualities, the development process during the excellence programmes can be accelerated.

In sum, this leads to the expectation that higher education students who participated in excellence programmes experienced a stronger development in cognitive and non-cognitive skills than students who did not participate in excellence programmes. This general hypothesis will be tested for five skills (cognitive and non-cognitive): critical thinking, creativity, leadership, political engagement, and obtained grades.

Data and methods

Data collection

We collected data from bachelor students in five Dutch higher education institutions: three research universities (i.e. *Maastricht University*, *Twente University*, and *Radboud University Nijmegen*), and two universities of applied sciences (*HAN University of Applied Sciences* and *Hanze University of Applied Sciences*). At each institution, students from one or two disciplines were selected. In most cases, the excellence programmes in these institutions span two years, from the second year of the bachelor's degree programme until the end of the programme (bachelor programmes in the Netherlands have a duration of three years). At each of these institutions, a questionnaire was circulated among bachelor's degree students in excellence programmes who had just started their excellence programme, and among all students in the same cohort who only took part in the regular education programme. A follow-up questionnaire was sent to the students who completed the questionnaire almost two years later, shortly before the end of the excellence programmes. In order to enhance the sample size, this was done for two separate student cohorts at each institution, the first starting in September 2016, and the second in September 2017. For most institutions, this means that the first measurement (t_0) took place at the start of students' second bachelor year, and the second measurement (t_1) was taken at the end of the third bachelor year. All questionnaires were available in Dutch and English. There are some slight variations between institutions in the exact timing of the data collection, the duration of the excellence programmes, the incentives the students received for taking part in the study, and the mode of data collection. A full overview of these details can be found in the Online Supplementary Materials (Supplementary Table 1).

The total number of students in excellence programmes and in regular programmes in the sample per cohort and per measurement moment is shown in [Table 1](#). In total, 588

Table 1. Total number of respondents per measurement moment for cohort 1 and cohort 2.

	t_0 measurement		Total
	Students in regular programmes	Students in excellence programmes	
Cohort 1	352	219	571
Cohort 2	236	242	478
Total	588	461	1,049
	t_1 measurement		Total
	Students in regular programmes	Students in excellence programmes	
Cohort 1	199	103	302
Cohort 2	150	107	257
Total	349	210	559

students filled in the questionnaire at t_0 in the first cohort, and in the second cohort 461 students participated in this measurement; in the t_1 measurement, this was reduced to 302 students in the first cohort and 257 students in the second cohort. This resulted in a total sample of $N = 1,049$ students and a longitudinal sample of $N = 559$ students, meaning that 53.3% of the respondents in the t_0 measurement were retained for the t_1 measurement. In the *Results* section we examine to what extent this sample attrition may have influenced our main conclusions. In this section we also discuss the findings from additional models in which we distinguished between eligible and non-eligible students in regular programmes, based on a questionnaire item in which students were asked to indicate whether they were eligible for participation in excellence programmes (e.g. by having sufficiently high grades in the first year of their bachelor's to meet the admission criteria). In our main analyses, however, we do not distinguish between eligible and non-eligible students in regular programmes, since the former group is relatively small in our sample (for cohort 1, at t_1 $n = 57$; for cohort 2, at t_1 $n = 49$).

Measures

This study uses a wide range of cognitive and non-cognitive outcome variables to best capture the broad variety of skills that students may develop during their participation in excellence programmes.¹ More specifically, the dependent variables used in this study are critical thinking skills, creativity skills, leadership skills, political engagement, and obtained grades.

Critical thinking skills are measured using two separate approaches: the objective Watson-Glaser test (Watson and Glaser 2010), and a subjective assessment of critical thinking based on learning strategies (Pintrich et al. 1991). The Watson-Glaser test uses 40 statements to test argumentation, assumptions, deductions, inferences and interpretations of texts. Based on the outcomes of the Watson-Glaser test,² percentile scores were calculated (separately for the t_0 and t_1 measurements) to represent critical thinking skills on a continuous scale. An additional analysis in which we used standardised test scores rather than percentile scores yielded similar results. The subjective measurement of critical thinking consists of a scale with a reliability of $\alpha = 0.71$, based on the average score on five Likert scale statements on learning strategies (see Pintrich et al. 1991). Surprisingly, there is no significant correlation between the objective Watson-Glaser test and the subjective measurement of critical thinking ($r = 0.021$). This may be due to the fact that they measure partly different dimensions, but it may also reflect biases in one or the other measure. In general, subjective measures are more prone to reporting bias and therefore correlate more strongly with other subjective measures such as satisfaction. Although the subjective measures may have a lower predictive validity for objective outcomes, they are still 'real' in the sense that they measure how people feel about this. We will therefore take a pragmatic approach and consider both measures for the analyses.

In order to measure *creativity*, we also used two separate approaches: the Alternate Uses Test (AUT; Guilford 1967) and a self-reported measure of creativity (Carson, Peterson, and Higgins 2005). The Alternate Uses Test assesses how many alternate uses of common household objects can be listed in thirty seconds. The items used in this questionnaire are a shoe, a button, keys, a wooden pencil, an automobile tire, and eyeglasses.

Based on the AUT test, three different indicators of creativity were derived: fluency (the total number of acceptable answers given), flexibility (the total number of categories in which acceptable answers were given), and perseverance (the number of acceptable answers per number of categories). Given that the main results were similar across all three indicators of creativity, we only present results for the flexibility measure of creativity in the remainder of this paper. The self-reported measure of creativity stems from the Creative Achievement Questionnaire and assesses how creative a person is within ten different dimensions, such as math, writing, art, and problem solving (see Carson, Peterson, and Higgins 2005). The measure represents creativity on a continuous scale, and scale reliability is found to be acceptable ($\alpha = 0.70$). As with the measures of critical thinking, the AUT and the self-reported creativity measure are not significantly correlated ($r = 0.009$), which again underlines that objective and subjective measures of the same concept may measure different things. Again we will take a pragmatic view and include both measures in the analyses.

The *leadership* skills of students are measured on a scale ($\alpha = 0.72$), calculated as the average of seven statements derived from Seligman, Park and Peterson (2004), in which students were asked to self-assess their leadership abilities on seven-point scales. *Political engagement* is measured by the number of politically and societally relevant activities (e.g. voting and attending protests) the student has undertaken in the last year. Finally, to measure the *obtained grades* of the students, we focus on self-reported average grades for the first, second and third year of the bachelor programme separately.

To measure the effect of participation in excellent programmes, two independent variables are of central importance. First, the *growth indicator* indicates the difference between the t_0 and t_1 measurement of the dependent variables. Second, we distinguish students who *participated in excellence programmes* and students who only participated in regular programmes. In our main analyses, this latter group also includes students who were eligible to participate in excellence programmes, but who for various reasons did not take part. We can compare the growth of the two student groups between t_0 and t_1 on the outcome variables by including an interaction term between the growth indicator and the variable for participation in excellence programmes.

Additionally, we control for various personal and social background characteristics of the students, in order to take into account pre-existing differences between students in excellence programmes and students in regular programmes before the start of the excellence programmes. These characteristics are included in our models at t_0 only; although several personal characteristics were also measured at t_1 , additional analyses have shown that there is indeed no or very little change in these characteristics between t_0 and t_1 . First, the *motivation* of the students is an important factor in the decision to apply for participation in excellence programmes, and also influences students' chances of being selected for participation. In the questionnaire, students' intrinsic and extrinsic motivation were derived based on four statements each on a seven-point scale from Pintrich et al. (1991). In our sample, the Cronbach's alpha is $\alpha = 0.59$ for the intrinsic motivation scale and $\alpha = 0.72$ for extrinsic motivation. Furthermore, we used the Grit scale to measure perseverance of effort and the scale for consistency of interest (Duckworth et al. 2007). Both concepts are measured by calculating the average score on six statements on a 5-point Likert scale. The reliability of the two combined scales is acceptable for both concepts, with $\alpha = 0.77$ for consistency of interest and $\alpha = 0.62$ for perseverance of effort.

Second, we included *personality traits* of the students. In the t_0 questionnaire the students considered 15 statements related to the Big Five personality traits: neuroticism, extraversion, agreeableness, conscientiousness, and openness (Goldberg 1993). Each personality trait was captured using three statements on a seven-point scale. For the current sample, the reliability of the subscales is $\alpha = 0.72$ for neuroticism; $\alpha = 0.75$ for extraversion; $\alpha = 0.67$ for openness; $\alpha = 0.50$ for agreeableness and $\alpha = 0.42$ for conscientiousness. Furthermore, the students indicated their self-efficacy (Midgley et al. 2000) on a seven-point scale ($\alpha = 0.77$). Finally, we include a single-item measure of students' risk preferences (Dohmen et al. 2011) on a ten-point scale.

Third, we take into account several *background characteristics* of the students and their parents. We control for the personal and parental migration background of the students by distinguishing between students with at least one parent born in the Netherlands versus students whose parents were born in other countries of origin. Additionally, we asked students which language was spoken at home, and we distinguish between Dutch and other languages in the analyses. The highest educational attainment of parents is determined based on the highest level attained between the father and the mother (maximum of both attained levels), and is categorised in four groups: primary education (basisonderwijs) and vocational track in secondary education (vmbo); academic tracks in secondary education (havo and vwo) and upper secondary vocational education (mbo); university of applied sciences (hbo); and research university (wo). For students whose parents did not complete their highest level of education in the Netherlands, educational levels were harmonised to the corresponding levels in the Dutch educational system. Finally, students were asked to provide information about their parental household income, by indicating whether this was below the modal income, approximately the modal income, or above the modal income.

Analytical model

In order to assess students' development during their participation in excellence programmes and/or the regular programmes, we use multilevel repeated measures models where the t_0 and t_1 measurements are nested within students (see e.g. Snijders and Bosker 2011). With these models, we can measure students' development over time while taking into account that the measurements at t_0 and t_1 are strongly correlated within students. Another advantage of these models is that we can also include information on respondents who only completed the t_0 measurement, in order to further enhance the robustness of the estimates at t_0 . An additional analysis in which we only included the longitudinal sample of respondents who completed both the t_0 and t_1 measurements did not lead to different conclusions.

The repeated measures model can be seen as a growth model over time t . This timing variable measures the growth between t_0 and t_1 in the cognitive and non-cognitive outcome variables. Additionally, we include an interaction effect (time * participation in excellence programmes versus regular programmes (0 = no versus 1 = yes)), which enables us to examine whether students in excellence programmes experience a stronger development of skills compared to students in regular programmes. Furthermore, we include the personal and social background characteristics as control variables, and we take into account differences between the institutions in our

sample by including fixed effect dummies for each institution. Finally, we include a dummy variable to control for differences between the two cohorts. In this paper, we only present results for each of the outcome variables based on the full models, in which all independent and control variables were included simultaneously. Results of models in which groups of variables were added to the analysis one by one can be found in the Online Supplementary Materials (Supplementary Tables 5–11). These models did not lead to different conclusions.

Results

In this section, we present the results of our analyses on the effects of participation in excellence programmes for each of the seven cognitive and non-cognitive outcome variables. For each outcome variable, the development between t_0 and t_1 is presented visually in figures, with two separate lines indicating the development trajectories of students in excellence programmes and students in regular programmes. In each figure, the orange line represents students who follow the regular programme, and the blue line represents students in excellence programmes. Additionally, the full regression results of the multilevel repeated measure models for all outcome variables are presented in Table 2.

Critical thinking

Critical thinking is measured using two different outcome variables: the percentile score on the Watson-Glaser test (results presented in Figure 1), and the self-reported scale score (Figure 2).

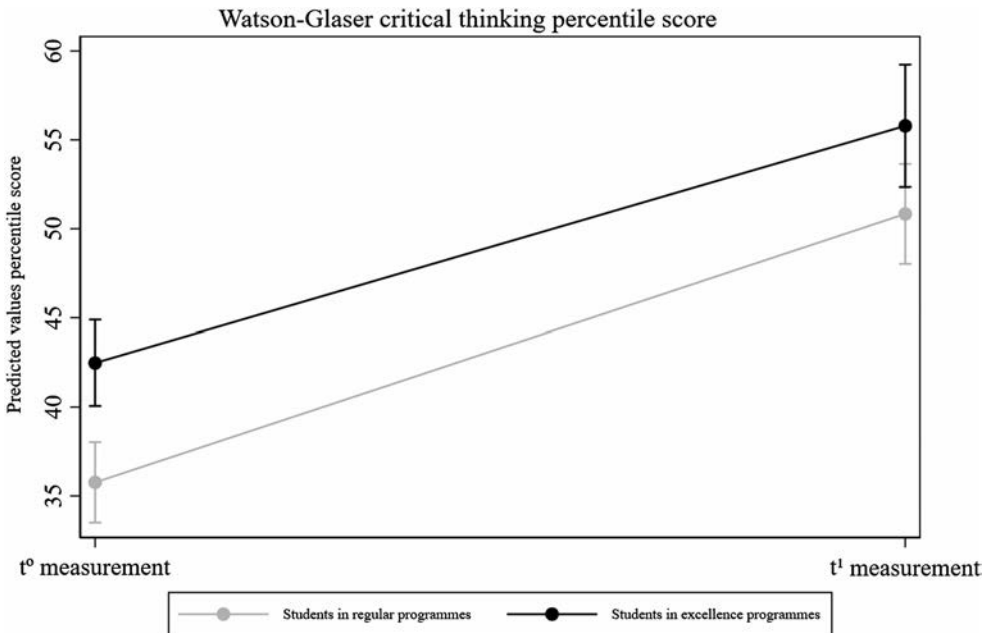


Figure 1. Growth in Watson-Glaser test score (percentile) between t_0 and t_1 .

Table 2. Results of multilevel repeated measures models for all outcome measures, including all independent and control variables.

	WG percentile score	Self-reported critical thinking	AUT flexibility	Self-reported creativity	Leadership	Political engagement	Average grades
<i>Independent variables</i>							
Students in excellence programmes (ref.=regular programmes)	6.780***	0.071*	0.432	-0.079***	-0.039	-0.006	0.632***
t ₁ measurement (ref.=t ₀ measurement)	15.108***	0.101***	0.180	0.003	0.086***	0.028**	0.107*
Students in excellence programmes * t ₁ measurement	-1.794	0.006	-0.023	0.033	-0.014	-0.002	-0.194**
<i>Control variables</i>							
Cohort 2018/2019 (ref.= cohort 2017/2018)	-2.081	-0.006	-3.479***	0.020	0.015	0.034*	-0.049
Migration background (ref.=other)							
At least one parent born in the Netherlands	10.123***	0.006	0.958*	-0.133***	-0.053	-0.049	0.019
Language spoken at home (ref.=other)							
Dutch language	18.534***	-0.111	0.618	0.090*	0.031	-0.035	-0.193
Highest educational attainment of parents (ref.=research university education)							
Primary or pre-vocational secondary	-6.313*	-0.132	-2.454***	-0.106*	0.109	0.010	-0.071
Upper secondary	-1.539	-0.006	-0.615	0.004	0.030	0.007	-0.034
University of applied sciences	-1.940	-0.038	-0.426	-0.039	-0.029	0.010	-0.101
Parental household income (ref.= modal income)							
Below modal income	-0.116	0.149**	-0.109	-0.012	-0.104**	0.026	-0.007
Above modal income	3.792**	0.072*	-0.019	0.003	0.013	0.016	0.057
<i>Motivation of the student</i>							
Intrinsic motivation	2.174	0.423***	0.417	0.019	0.032	0.000	-0.013
Extrinsic motivation	-0.296	-0.028	-0.129	-0.028	0.014	-0.012	0.071
Grit: consistency of interest	-3.292***	-0.049*	-0.582***	-0.026	0.035	-0.010	0.001
Grit: perseverance of effort	-4.500***	0.049	0.024	0.095***	0.061*	0.028	-0.009
<i>Personality traits of the student</i>							
Neuroticism	-2.964***	-0.025	-0.227	0.027	-0.016	0.007	0.018
Extraversion	-2.632***	-0.038*	0.239	0.060***	0.184***	0.021*	0.052
Openness	-0.932	0.216***	0.420**	0.265***	0.052***	0.040***	-0.053
Agreeableness	-1.402	-0.053**	-0.318	-0.004	0.129***	-0.014	0.037
Conscientiousness	-1.790	-0.020	-0.161	0.047*	0.068**	-0.004	0.157**
Self-efficacy	8.917***	0.232***	0.568	0.120***	0.264***	0.023	0.132
Risk preferences	-1.178***	0.020**	-0.109	0.027***	0.007	0.005	-0.025
Institution fixed effects							
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	53.693***	0.675***	13.987***	1.054***	0.768***	0.063	6.055***
var(Constant individual)	213.627***	0.119***	5.573***	0.081***	0.095***	0.043***	0.314***
var(Residual)	343.467***	0.186***	14.289***	0.081***	0.105***	0.024***	0.171***
N (t ₀)	853	896	892	896	896	718	421
N (t ₁)	438	438	447	437	438	437	206

Note: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$. Coefficients shown are unstandardised B estimates. For average grades, t₀ refers to the end of year 1, and t₁ refers to the end of year 3.

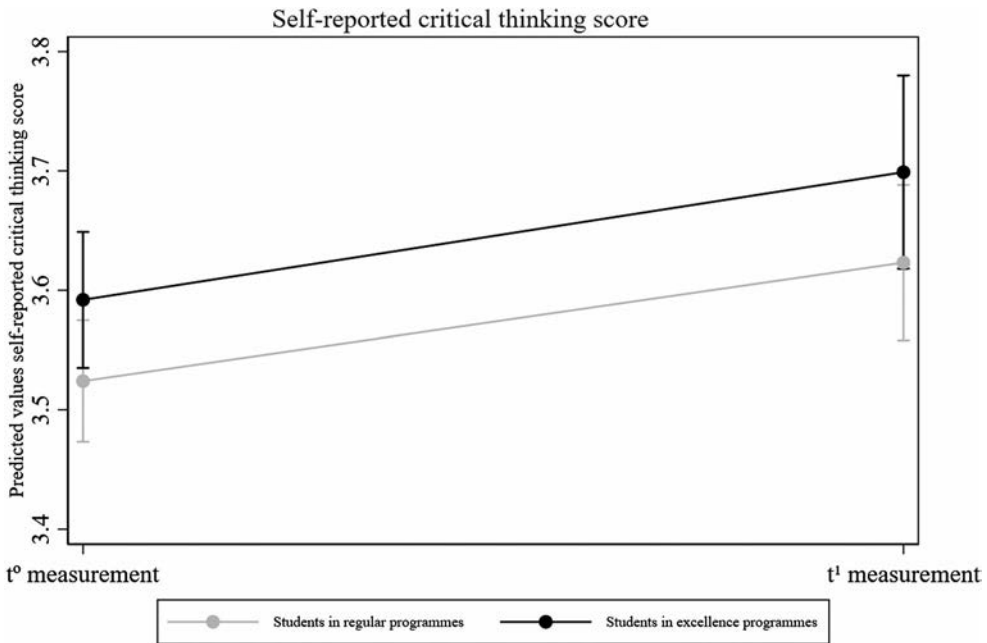


Figure 2. Growth in self-reported critical thinking skills between t_0 and t_1 .

For the percentile score on the Watson-Glaser test, we see that both students in regular programmes and students in excellence programmes experience a significant growth in their critical thinking skills. As expected, the students in the excellence programmes started off at a slightly higher level, but there is no significant difference in the strength of development between the two groups. Figure 2 shows a similar finding for the subjective measure of critical thinking: again, both students in regular programmes and students in excellence programmes experience growth in critically evaluating and assessing learning strategies, without there being a significant difference between the two groups. For both groups, the growth in self-reported critical thinking skills appears to be much more modest compared to the results for the Watson-Glaser test score.

Creativity

Creativity was also measured using two different outcome variables, presented in Figure 3 (the AUT flexibility score) and Figure 4 (the subjective creativity score).

The results presented in Figure 3 show that both students in regular programmes and students in excellence programmes experienced barely any growth in creativity between the t_0 and t_1 measurements: at the time of the t_1 measurement, the number of categories that they could give acceptable answers in was not significantly greater than at the time of the t_0 measurement. Additionally, there is no significant difference in the strength of development between the two groups. Moreover, both at the start and at the end of the programme both groups do not significantly differ. Figure 4 shows that for the self-reported creativity the two groups did start off at different levels, but contrary to what might have been expected, the students in the regular programmes reported a

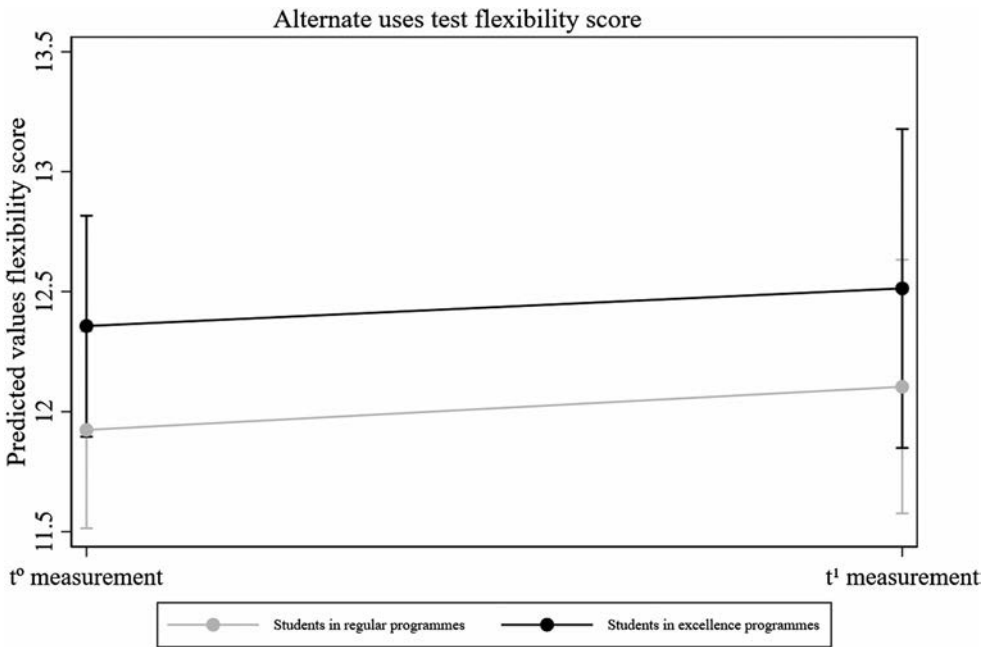


Figure 3. Growth in AUT flexibility score between t_0 and t_1 .

higher level of creativity. Moreover, [Figure 4](#) suggests that the growth in creativity that we observed for the objective measure is mirrored in students' own assessments of their creativity: for both groups of students, self-reported creativity scores have barely changed between t_0 and t_1 .

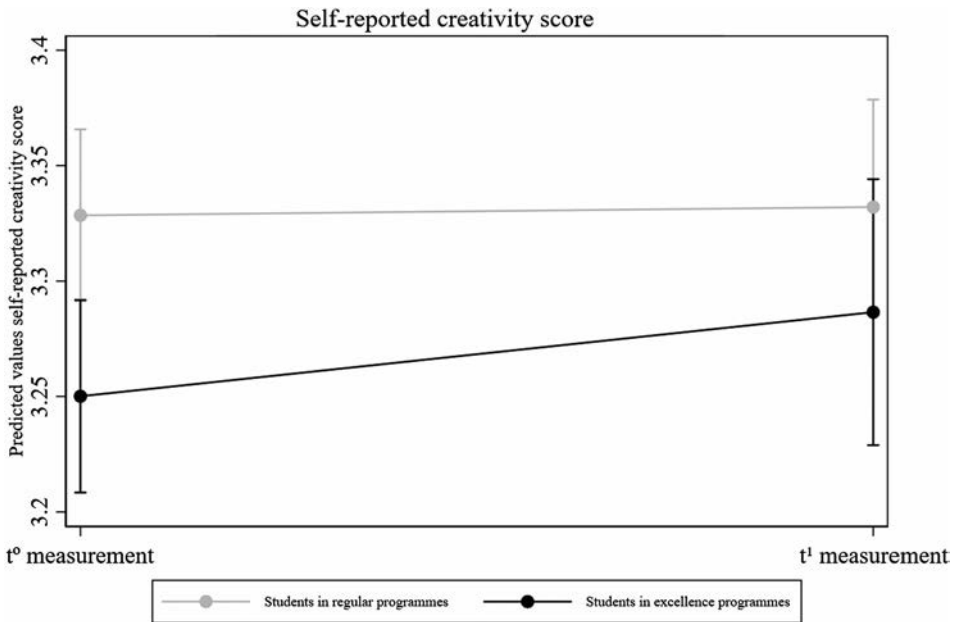


Figure 4. Growth in self-reported creativity score between t_0 and t_1 .

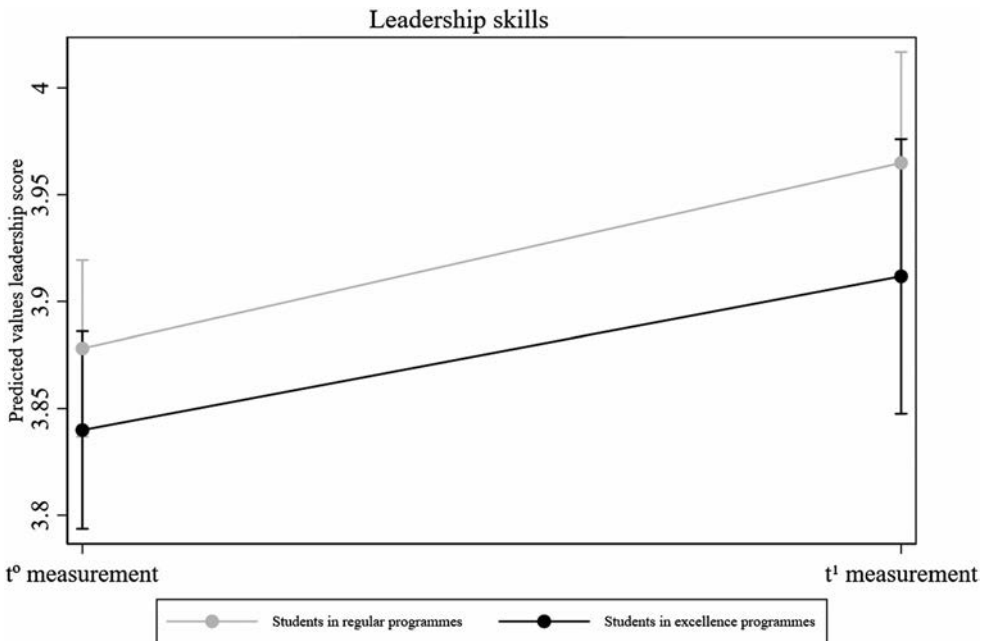


Figure 5. Growth in leadership skills between t_0 and t_1 .

Leadership

Figure 5 shows the results on the development of students' leadership skills between the t_0 and t_1 measurements. We see that both students in regular programmes and students in excellence programmes experienced some growth in their leadership skills, but in substantive terms this growth remains fairly limited (around 0.1 points on the scale) and we do not find a significant difference in the strength of development between the two groups. Moreover, both at the start and at the end of the programme both groups do not significantly differ.

Political engagement

Results relating to political engagement are presented in Figure 6. In the t_0 measurement students in regular programmes and students in excellence programmes scored nearly the same, and for both groups we see only a very modest increase in political engagement in the t_1 measurement. Moreover, once again the development trajectories of both groups were not significantly different.

Obtained grades

The development of obtained grades as measured by average grades for years 1, 2 and 3 is presented in Figure 7. The results show that students in excellence programmes had significantly higher obtained grades in the first year compared to students in regular programmes. This is not surprising, since admission into excellence programmes is often dependent on obtained grades in the first year, and some students may actively work towards meeting the admission criteria for excellence programmes. When we look at

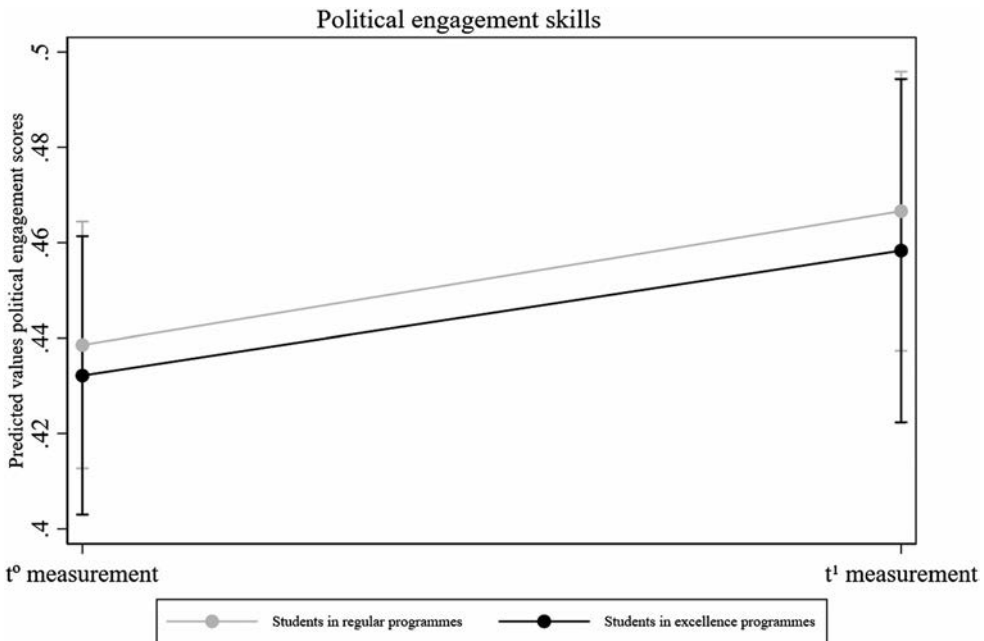


Figure 6. Growth in political engagement between t_0 and t_1 .

the development of obtained grades across the three years, we see that students in regular programmes experience a small and non-significant improvement in their average grades. For students in excellence programmes, however, we find a minor but also non-significant decline in their average grade during the course of the programme. Nonetheless, in the second and third year, students in excellence programmes continue to obtain significantly higher average grades than students in regular programmes. For one institution (Maastricht University), we were able to confirm whether using objective student administration data on average grades would lead to different findings than self-reported average grades; our results revealed that this was not the case.

Robustness checks

We performed several robustness checks to assess the robustness of our findings (results are available from the authors upon request). First, we distinguished between students who were eligible to take part in excellence programmes but did not start for various reasons, and the other students who did not take part in excellence programmes. The results indicate that in terms of their cognitive and non-cognitive skills, these students perform more or less in between regular students and students in excellence programmes. Their development between t_0 and t_1 is similar to that of these two other groups. Excluding this group from the analysis, or comparing the development of students in excellence programmes to the development of only this specific control group of eligible students, did not lead to different conclusions.

Second, we conducted separate analyses for students in universities of applied sciences and students at research universities. The main conclusions about the effects of

participation in excellence programmes are similar for both types of institutions. Third, we included additional interaction effects with background characteristics (i.e. migration background, parental educational attainment, and parental household income) to test whether certain groups of students experienced different effects of participation in excellence programmes. These additional analyses suggest that there are no differential effects of participation in excellence programmes based on these background characteristics. However, it should be kept in mind that our sample is too small to fully capture the potential heterogeneity of the effects of participation in excellence programmes, and that we therefore need to be careful in drawing conclusions about differences between social groups based on these results.

Finally, in order to assess the impact of the sample attrition on our main findings, we examined to what extent the students who only took part in the t_0 measurement appeared to be a selective group. We did this by comparing the scores on the outcome variables and the personal and social background characteristics between this group of students and the students who participated in both the t_0 and t_1 measurements. We found that the two groups of students did not differ significantly, with one exception: students who only took part in the t_0 measurement had significantly lower scores on the AUT creativity test. A possible explanation for this could be that students who did not perform well in the AUT in the t_0 measurement were reluctant to complete the AUT again, and therefore decided not to take part in the t_1 measurement. For our results, this implies that the lack of change in the AUT scores between t_0 and t_1 may possibly be explained partly by sample attrition. For the other outcome variables, however, our results suggest that it is unlikely that attrition has influenced our main conclusions.

Conclusions and discussion

This study focused on the effects of participation in excellence programmes on multiple cognitive and non-cognitive outcomes. We used repeated measures models that examined whether students in excellence programmes experienced a stronger development of cognitive and non-cognitive skills than students in regular programmes during the second and third years of their bachelor's degree. In doing so, our models took into account differences in skills at the start of the programme between regular students and students in excellence programmes, as well as multiple personal and social background characteristics of the students.

The most important conclusion from the results is that students in excellence programmes have developed positively on almost all cognitive and non-cognitive outcome measures. However, students in regular programmes experienced a similar positive growth, and there is no significant difference in this positive development between the two groups. Additionally, there is no indication that students in excellence programmes experience any negative side effects from following an excellence programme. Participating in these programmes does not seem to negatively affect grades: students in excellence programmes receive higher grades than students in regular programmes along the entire course of the regular bachelor programme. In general, students in excellence programmes score higher on the outcome measurements presented in this study than students in regular programmes. This difference was already present at the start of the excellence programmes, and it hardly changed during the course of the programmes.

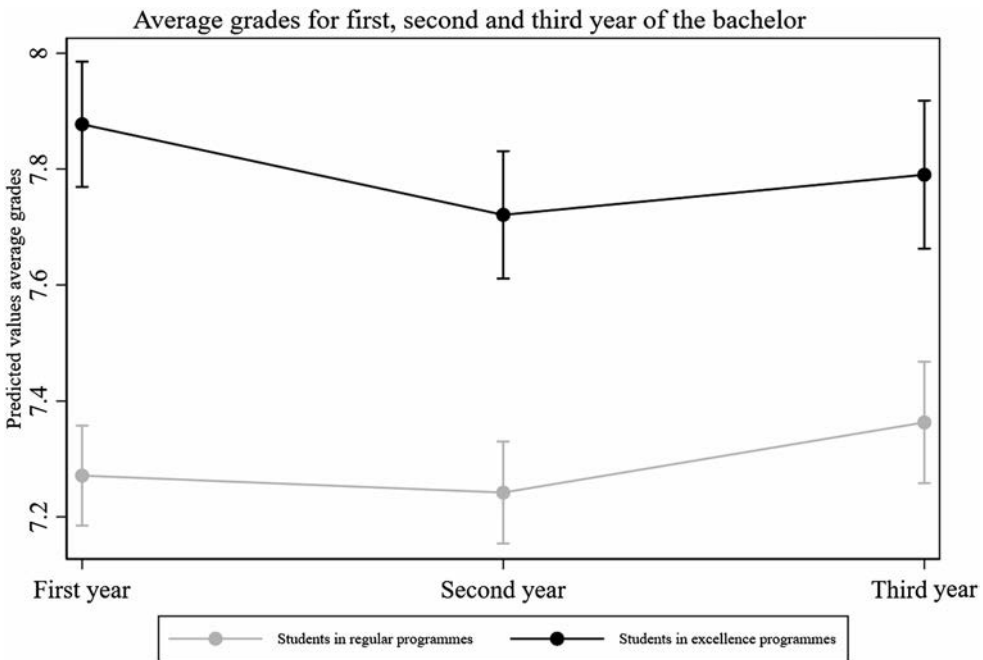


Figure 7. Growth in average grades between years 1, 2 and 3.

Adding a further distinction within our control group between students in regular programmes who were not eligible for participation in excellence programmes, and students in regular programmes who were eligible but for various reasons did not participate, did not lead to different results.

In this study, we have used a broader range of indicators of cognitive and non-cognitive skills than most previous studies on the effects of excellence programmes. It is important to highlight that our conclusions are similar for both cognitive and non-cognitive skills. This means that generally the effects of participation in excellence programmes do not depend on the exact outcome measure chosen. Moreover, this indicates that our main conclusions are robust to different selections and specifications of the outcome measures.

This study has also experienced several limitations worth mentioning. First, as shown in the *Data and methods* section, between the first and second measurement we lost almost half of the sample due to attrition. Unfortunately, we were not able to establish to what extent this was due to students dropping out of their bachelor's programme, and to what extent this was rather caused by non-response on the second measurement. However, as discussed in the *Results* section, an analysis on which students only took part in the first measurement showed that all in all the group of students that did not participate in the second measurement did not differ greatly from the students who remained in the sample. This means that it is unlikely that the main conclusions of this study are affected by the sample attrition. Second, it would have been preferable to use student administration data from each of the five higher education institutions in this study, such as data relating to obtained grades in the bachelor's programme, rather than

having to rely mostly on self-reported average grades. However, the introduction of the GDPR law limited the opportunities to retrieve this information: only one institution granted permission to use the relevant student administration data. It is reassuring that for this institution the administration data did not lead to different conclusions compared to the self-reported average grades. Third, in theory it would have been interesting to use a regression discontinuity design to examine the added value of participation in excellence programmes. By focusing only on students who were eligible for participation in excellence programmes, and thereby directly comparing the development of students who achieved almost the same grades in the first year of their bachelor's programme, the possible role of selection effects could have been examined even more closely. However, in the context of excellence programmes in the Netherlands, this design proved to be problematic. For several excellence programmes, in practice there is no 'hard' grade requirement for admission (see also the other article by Jacobs et al. ([forthcoming](#)) in this special issue), which makes it difficult to have a clear distinction between eligible and non-eligible students, which is essential to apply a regression discontinuity design. Additionally, excellence programmes that do maintain strict selection criteria vary in their exact admission requirements, which makes it difficult to perform a pooled analysis on all institutions, and the sample size is insufficient to conduct separate regression discontinuity analyses for each institution. However, since the models in which we distinguished between students who were eligible for participation in excellence programmes and students who were not eligible showed that all groups of students experienced similar trajectories of development, it is unlikely that applying a regression discontinuity design would have changed our main conclusions.

Although this study adds to existing knowledge about the effects of participation in excellence programmes, several interesting questions remain for future research on this topic. Most importantly, we did not incorporate the students' perspectives on excellence programmes. For example, how do students expect to benefit from excellence programmes, and what do they see as the main added value of participation? The importance of these questions is underlined by the fact that our results suggest that motivation (both intrinsic and extrinsic) plays an important role in the development of skills. Related to this, it would be interesting to more closely examine students who dropped out of excellence programmes and their reasons for dropping out, and to see whether these relate to the programmes as such, or rather to external factors. The article by Leest and Wolbers (under review) in this special issue sheds some light on this.

All in all, this study has shown that higher education students in excellence programmes in the Netherlands experienced a positive development in their cognitive and non-cognitive skills over the two years that they took part in the programme. However, because the results also showed that students who did not participate in excellence programmes experienced a similar development, it may be tempting to conclude that participating in excellence programmes does not have any added value. This would not do justice to the visions and aims of excellence education in the Netherlands: many excellence programmes do not have the single goal of improving certain cognitive and non-cognitive skills of excellent students, but also, for example, of broadening or deepening knowledge (Allen et al. 2015; Hernández-Torrano and Saranlı 2015; Renzulli 2002). Moreover, excellence pathways are ideally suited to provide tailor-made learning pathways: each student develops in different domains, so development trajectories and

learning outcomes will also vary from person to person (Bhatt 2009). This is also in line with the vision of excellence education as talent development: the educational institution offers education in which all students can perform optimally, regardless of how talented they are (Allen et al. 2015). In this way, it is possible that the growth that students have experienced in excellence programmes is still partly due to participating in these programmes, and to the ‘match’ between specific students and programmes. It therefore remains an open question whether these students would have experienced a similar growth if they would have not participated in excellence programmes.

Notes

1. A detailed overview of the exact wording of all the items as included in the questionnaire (with the exception of the copyrighted Watson-Glaser test and Alternate Uses Test) can be found in Supplementary Table 2 in the Online Supplementary Materials). Additionally, descriptive statistics of all variables included in this study are presented in Supplementary Table 3 (for the t_0 measurement) and Supplementary Table 4 (for the t_1 measurement).
2. The Watson-Glaser test uses norm groups to anchor the critical thinking scores of the respondents, and norm groups vary slightly between different language versions of the test. We used the norm group ‘working adults’ to derive critical thinking scores among students who completed the Dutch language version of the test, and norm group ‘bachelor degree’ for critical thinking scores among students who completed the English language version, since these norm groups most closely resemble the higher education students in our sample. The percentile scores therefore also refer to percentiles within the norm groups.

Disclosure statement

No potential conflict of interest was reported by the author(s).

Funding

The research presented in this article was funded by the Netherlands Initiative for Education Research (NRO), project number 405-15-601. Nationaal Regieorgaan Onderwijsonderzoek.

Notes on contributors

Madelon Jacobs is a researcher at the Research Centre for Education and the Labor Market (ROA), Maastricht University. She is interested in research related to social inequalities in education, work-life balance and effectiveness of education.

Kim van Broekhoven is a postdoctoral researcher at Radboud University in Nijmegen. The focus of her research is on the development of creativity in higher education. More specifically, how to design or structure creative challenges (e.g. the kind of rewards, creative examples, instruction, feedback). Another, related line of research focuses on the psychological safety in the classroom. In order to reach the potential of these creative challenges, a safe place for unsafe learning is essential.

Tim Huijts is Research Leader at the Research Centre for Education and the Labour Market (ROA). He obtained an MSc (2006, cum laude) and PhD (2011, cum laude) in Sociology at the Radboud University Nijmegen. Before joining ROA in April 2018, he worked as Assistant Professor at Utrecht University, Postdoctoral Researcher at the University of Oxford, Lecturer at Queen Mary University of London, and Senior Lecturer at the University of York. In his research he examines how national and institutional factors influence social inequalities, and how these

factors moderate the impact of education and employment on outcomes such as health and well-being. His work has appeared in a broad range of journals in Sociology, Demography and Public Health, and he received a Philip Leverhulme Prize (2017) for outstanding achievement.

Stefan Straetmans is an Associate Professor of Finance at Maastricht University in the Netherlands. His research includes, inter alia, the modelling and measurement of systemic risk, financial risk and financial crisis management, financial market contagion, linkages and integration. Parts of his work have been published in international academic journals like the *Review of Economics and Statistics*, the *Journal of Applied Econometrics*, *Oxford Bulletin of Economics and Statistics*, the *Journal of International Money and Finance* and the *Journal of Banking and Finance*. He is also coordinating the Bsc Honours programme at Maastricht University's School of Business and Economics.

Christoph Meng is Coordinating senior researcher at the Research Centre for Education and the Labour Market (ROA) of Maastricht University Christoph Meng graduated in Economics from the University of Zurich in 1997. In 1998 he obtained his Masters' degree in International Economics at Maastricht University where he also obtained his PhD in 2006. His main research interests are the transition from school to work, determinants of drop-outs, the acquisition and role of competencies and gender-based wage-gaps.

Rolf van der Velden is professor at Maastricht University, director of the Research Centre for Education and the Labour Market (ROA) and programme director Education and Occupational Career at the same institute. He is research fellow at the Graduate School of Business and Economics (GSBE) at Maastricht University and fellow of the Amsterdam Centre for Learning Analytics (ACLA). He supervised several (inter)national studies on the transition from school to work, among others the international REFLEX project. Currently he is coordinator of the Netherlands Education Cohort Study (<https://nationaalcohortonderzoek.nl/>) of the Netherlands Initiative for Education Research (NRO) and advisor for the PIAAC project (<http://www.oecd.org/site/piaac>).

ORCID

Madelon Jacobs  <http://orcid.org/0000-0002-6245-8485>

Tim Huijts  <http://orcid.org/0000-0002-2085-4113>

Kim van Broekhoven  <http://orcid.org/0000-0002-1618-3345>

Stefan Straetmans  <http://orcid.org/0000-0003-2612-4258>

Christoph Meng  <http://orcid.org/0000-0003-3221-9763>

Rolf van der Velden  <http://orcid.org/0000-0003-4161-8125>

References

- Allen, J., B. Belfi, R. van der Velden, B. Jongbloed, R. Kolster, D. F. Westerheijden, K. van Broekhoven, B. Leest, and M. H. J. Wolbers. 2015. 'Het beste uit studenten'; *Onderzoek naar de werking van het Sirius Programma om excellentie in het hoger onderwijs te bevorderen*. Nijmegen: ITS, Radboud University.
- Becker, G. S. 1962. "Investment in Human Capital: A Theoretical Analysis." *Journal of Political Economy* 70 (5, Part 2): 9–49.
- Bhatt, R. R. 2009. "The impacts of gifted and talented education." *Andrew Young School of Policy Studies Research Paper Series* 9–11.
- Carson, S. H., J. B. Peterson, and D. M. Higgins. 2005. "Reliability, Validity, and Factor Structure of the Creative Achievement Questionnaire." *Creativity Research Journal* 17 (1): 37–50.
- Dai, D. Y., J. A. Swanson, and H. Cheng. 2011. "State of Research on Giftedness and Gifted Education: A Survey of Empirical Studies Published During 1998–2010 (April)." *Gifted Child Quarterly* 55 (2): 126–138.

- Davis, G. A., and S. B. Rimm. 1989. *Education of the Gifted and Talented*. Englewood Cliffs, NJ: Prentice-Hall, Inc.
- Dohmen, T., A. Falk, D. Huffman, U. Sunde, J. Schupp, and G. G. Wagner. 2011. "Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences." *Journal of the European Economic Association* 9 (3): 522–550.
- Duckworth, A. L., C. Peterson, M. D. Matthews, and D. R. Kelly. 2007. "Grit: Perseverance and Passion for Long-Term Goals." *Journal of Personality and Social Psychology* 92 (6): 1087.
- Gagné, F. 2000. "A Differentiated Model of Giftedness and Talent (DMGT)." *Systems and Models for Developing Programs for the Gifted and Talented* 25 (2): 171–172.
- Goldberg, L. R. 1993. "The Structure of Phenotypic Personality Traits." *American Psychologist* 48 (1): 26.
- Guilford, J. P. 1967. *The Nature of Human Intelligence*. New York: McGraw-Hill.
- Heijltjes, A. E. G. 2014. "Cultivating Critical Thinking: The Effects of Instructions on Economics Students' Reasoning." *Erasmus University Rotterdam*. Retrieved from <http://hdl.handle.net/1765/50418>
- Hernández-Torrano, D., and A. G. Saranlı. 2015. "A Cross-Cultural Perspective About the Implementation and Adaptation Process of the Schoolwide Enrichment Model: The Importance of Talent Development in a Global World." *Gifted Education International* 31 (3): 257–270.
- Jacobs, M., B. Leest, T. Huijts, and C. Meng. forthcoming. How are students selected for excellence programmes in the Netherlands? An analysis of selection procedures using vignette data. *European Journal of Higher Education*.
- Kautz, T., J. J. Heckman, R. Diris, B. Ter Weel, and L. Borghans. 2014. *Fostering and Measuring Skills: Improving Cognitive and non-Cognitive Skills to Promote Lifetime Success* (No. w20749). Cambridge, MA: National Bureau of Economic Research.
- Kool, A., T. Mainhard, D. Jaarsma, P. van Beukelen, and M. Brekelmans. 2017. "Effects of Honours Programme Participation in Higher Education: a Propensity Score Matching Approach." *Higher Education Research & Development* 36 (6): 1222–1236.
- Midgley, C., M. L. Maehr, L. Z. Huda, E. Anderman, L. Anderman, K. E. Freeman, and T. Urdan. 2000. "Manual for the Patterns of Adaptive Learning Scales." *Ann Arbor* 1001: 48109–41259.
- Ministry of Education, Culture, and Science. 2011. *Strategische Agenda Hoger Onderwijs, Onderzoek en Wetenschap*. Kwaliteit in verscheidenheid. Retrieved from: <https://wp.asva.nl/asva/wp-content/uploads/sites/2/2019/04/kwaliteit-in-verscheidenheid.pdf>.
- Pintrich, P. R., T. Garcia, W. J. McKeachie, and D. A. Smith. 1991. *Motivated Strategies for Learning Questionnaire*. Ann Arbor, MI: Regents of the University of Michigan.
- Renzulli, J. S. 2002. "Emerging Conceptions of Giftedness: Building a Bridge to the new Century." *Exceptionality* 10 (2): 67–75.
- Scager, K., S. F. Akkerman, F. Keesen, M. Tim Mainhard, A. Pilot, and T. Wubbels. 2012. "Do Honors Students Have More Potential for Excellence in Their Professional Lives?" *Higher Education* 64 (1): 19–39.
- Seligman, M. E. P., N. Park, and C. Peterson. 2004. "The Values In Action (VIA) Classification of Character Strengths." *Ricerche di Psicologia* 27 (1): 63–78.
- Snijders, T. A., and R. J. Bosker. 2011. *Multilevel Analysis: An Introduction to Basic and Advanced Multilevel Modeling*. London, UK: Sage.
- Subotnik, R. F., P. Olszewski-Kubilius, and F. C. Worrell. 2011. "Rethinking Giftedness and Gifted Education: A Proposed Direction Forward Based on Psychological Science." *Psychological Science in the Public Interest* 12 (1): 3–54.
- Watson, G. B., and E. M. Glaser. 2010. *Watson-Glaser II Critical Thinking Appraisal Technical Manual and User's Guide*. London: The Psychological Corporation.
- Wolfensberger, M. V. C., P. J. van Eijl, and A. Pilot. 2004. "Honours Programmes as Laboratories of Innovation: A Perspective from the Netherlands." *Journal of the National Collegiate Honors Council Online Archive*. 141: 115–142.