DE IMPACT VAN WERKPLEKLEREN VERSUS LEREN OP SCHOOL OP COGNITIEVE EN NIET-COGNITIEVE UITKOMSTEN IN HET SECUNDAIR ONDERWIJS

Ilse Tobback, Dieter Verhaest & Kristof De Witte

SONO

STEUNPUNT ONDERWIJS ONDERZOEK

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Inhoud

Beleidssamenvatting

Verschillende studies vinden dat beroepsopleidingen, bovenal programma's met werkplekleren, gepaard gaan met een soepelere overgang van onderwijs naar de arbeidsmarkt in vergelijking met meer algemene opleidingen. Hoewel dit relatieve voordeel voor beroepsopgeleiden aan meerdere factoren kan worden toegeschreven, is de meest prominente verklaring dat leren op de werkplek het mogelijk maakt om sociale en professionele vaardigheden te ontwikkelen die onmiddellijk toepasbaar zijn op de arbeidsmarkt. Verder speelt er mogelijk ook een indirect effect door het verminderen van vroegtijdig schoolverlaten en het verbeteren van de kansen op een kwalificatie. Deze resultaten suggereren dat leren op een werkplek ook de niet-cognitieve resultaten, zoals motivatie en betrokkenheid, van studenten kan verhogen. Ondanks deze relatieve voordelen vinden sommige recente studies dat beroepsopgeleiden later in hun loopbaan veeleer slechter af zouden zijn. Zo zou de focus op specifieke vaardigheden tijdens de opleiding ten koste kan gaan van meer algemene vaardigheden zoals rekenvaardigheid, geletterdheid en abstract denken, wat op lange termijn de inzetbaarheid van deze individuen kan aantasten. In tegenstelling tot algemene vaardigheden zijn meer specifieke vaardigheden immers onderhevig aan veroudering. Bovendien beïnvloedt een focus op specifieke vaardigheden in het secundair onderwijs mogelijk zowel de overgang naar, als de academische resultaten in het hoger onderwijs op een negatieve manier.

Of en hoe (het aantal uren) leren op een werkplek de cognitieve en niet-cognitieve resultaten in het secundair onderwijs effectief beïnvloedt, is tot nu toe evenwel nauwelijks wetenschappelijk onderzocht. Recente studies vinden wel een negatieve associatie tussen beroepsopleidingen (versus algemene opleidingen) en cognitieve vaardigheden. Ook voor niet-cognitieve resultaten focussen de meeste studies op de kloof tussen beroeps- en algemene opleidingen, in plaats van op de effecten van leren op de werkplek als zodanig. De resultaten zijn bovendien niet sluitend. Waar sommige studies een positieve invloed vinden van beroepsopleidingen op de veerkracht en zelfbeheersing van studenten, vinden andere geen significante effecten voor de beheersingsoriëntatie (Locus of Control) en het academisch zelfconcept van studenten.

In deze studie onderzoeken we de invloed van het substitueren van leren in een schoolsetting voor leren in een werksetting (stage) op de cognitieve en niet-cognitieve resultaten in het secundair onderwijs. Hiervoor maken we gebruik van de longitudinale data van Vlaamse scholieren in het secundair onderwijs verzameld door het 'Loopbanen in het Secundair Onderwijs' (LiSO) project, waarbij de schoolloopbanen en de ontwikkeling van leerlingen doorheen het secundair onderwijs in kaart worden gebracht. Deze databank bevat informatie over een uitgebreide set aan cognitieve vaardigheden zoals rekenvaardigheid en begrijpend lezen, en niet-cognitieve uitkomsten zoals motivatie, betrokkenheid, academisch zelfconcept en welbevinden van studenten in het voltijds secundair onderwijs. Om causale uitspraken te kunnen maken, is het belangrijk om te corrigeren voor de niet-willekeurige selectie van leerlingen in studieprogramma's. Om hiervoor te corrigeren en om de impact van stage expliciet te ontwarren van andere aspecten van beroepsopleidingen, vergelijken we programma's met verschillende hoeveelheden stage binnen vergelijkbare beroepsopleidingen in hetzelfde studiegebied en dezelfde school. Daarnaast controleren we ook op gedetailleerde wijze voor andere bronnen van heterogeniteit, zoals de (niet-)cognitieve resultaten in het voorgaande schooljaar, en verschillende achtergrondkenmerken.

Interessant aan de Vlaamse context van het secundair onderwijs is dat ze ons bovendien toelaat om de impact van leren op de werkplek te testen en te vergelijken binnen twee verschillende trajecten van het arbeidsmarktgerichte onderwijs: het beroepssecundair onderwijs (BSO) met de arbeidsmarkt als finaliteit, en het technisch secundair onderwijs (TSO) met een dubbele finaliteit (arbeidsmarkt en hoger onderwijs).[*] Gegeven deze verschillen in finaliteit verwachten we dat de substitutie van tijd besteed aan het leren in een schoolsetting voor leren in een werksetting, een sterker (negatief) effect zal hebben op de cognitieve vaardigheden in het TSO dan in het BSO.

Globaal gezien zijn onze resultaten inderdaad consistent met voorgaande argumenten. Of effecten naar voren komen, blijkt evenwel in grote mate afhankelijk van het traject. Voor TSO-leerlingen vinden we dat een grotere nadruk op stage (i.p.v. schools leren) de cognitieve en niet-cognitieve onderwijsresultaten op een negatieve manier beïnvloedt. Een toenemende participatie in stage, leidt tot een vermindering van de uitkomsten op het vlak van wiskunde en leesvaardigheid voor TSO-leerlingen. Verder blijkt ook hun autonome motivatie, betrokkenheid en welzijn (disengagement) te verminderen (verhogen). Bovendien blijken de effecten voor een aantal van deze uitkomsten aanzienlijk. Zo suggereren onze schattingen dat het implementeren van een stage van gemiddelde duur (4.1 weken) iemands' score op het vlak van wiskunde (leesvaardigheid) met 40,2% (25,4%) van een standaardafwijking reduceert.

Voor BSO-leerlingen zijn de resultaten veel genuanceerder. Hoewel onze basisanalyse suggereerde dat het gemiddelde effect op wiskunde, leesvaardigheid en gecontroleerde motivatie (disengagement) ook voor deze studenten negatief (positief) is, zijn deze resultaten niet bij alle analyses even robuust. Bovendien geven aanvullende analyses aan dat het effect op wiskunde, leesvaardigheid en gedragsmatige betrokkenheid zelfs positief kan zijn voor beperkte hoeveelheden van werkplekleren (tot ongeveer vier weken per schooljaar). Voor BSO-leerlingen vonden we verder ook

[*] Binnen dit onderzoek focussen we op studenten in het voltijds secundair onderwijs die participeren in een korte stage als onderdeel van hun opleiding in het zesde middelbaar.

consequent een substantieel, negatief effect van stage op amotivatie (d.w.z. niet weten waarom men op school zijn/haar best zou doen). Een stage met een gemiddelde duur van 4.1 weken zou naar schatting de amotivatie van leerlingen in het beroepstraject met 84,5% van een standaardafwijking reduceren.

Wanneer beleidsmakers en schoolbesturen zich buigen over (de hoeveelheid) stages binnen programma's, worden ze dus geconfronteerd met een complexe puzzel waarbij de richting en omvang van het effect van stage op (niet-)cognitieve uitkomsten sterk afhangt van het type traject waarin schools leren wordt vervangen door werkplek leren, het (niet-)cognitieve resultaat dat in aanmerking wordt genomen en de hoeveelheid stage dat wordt geïmplementeerd. Globaal gezien suggereren onze resultaten dat de effecten van stages veelbelovender zijn voor het bevorderen van cognitieve en (niet-)cognitieve uitkomsten voor gematigde hoeveelheden van werkplekleren (tot ongeveer een maand per schooljaar) in het BSO, en dat ze schadelijker zijn voor deze uitkomsten wanneer ze worden geïmplementeerd in het TSO. Deze effecten verschillen mogelijk evenwel afhankelijk van de inhoud en kwaliteit van de stages, en moeten afgewogen worden tegenover de potentiële voordelen van stage met betrekking tot de verwerving van meer beroepsspecifieke en/of professionele vaardigheden, zoals timemanagement en interpersoonlijke vaardigheden. Vermits het belang van de inhoud en kwaliteit van stages en de verwerving van beroepsspecifieke en professionele vaardigheden evenwel niet onderzocht zijn in onze studie, adviseren wij verder onderzoek in die zin. Verder focust ons onderzoek op stages in het voltijds technisch en beroepssecundair onderwijs. Hoewel onze onderzoeksresultaten ook relevantie hebben met betrekking tot alternerende opleidingen (zoals duaal leren), kunnen zij niet zomaar geëxtrapoleerd worden naar deze context. Wij adviseren daarom ook verder onderzoek naar de invloed van het substitueren van leren in een schoolsetting voor leren in een werksetting op de (niet-)cognitieve resultaten in alternerende opleidingen.

Engelstalig wetenschappelijk artikel

The impact of work-based versus school-based learning on cognitive and non-cognitive outcomes in secondary education†

Ilse Tobback,‡ Dieter Verhaest,§ and Kristof De Witte**

Abstract. We investigate how work-based versus school-based learning impacts students' cognitive and non-cognitive educational outcomes in secondary education. To this end, we exploit the longitudinal LiSO dataset, collected among a cohort of students in Flanders (Belgium) throughout their secondary education career. In our analyses, we control for school-field-of-study fixed effects, longitudinal test-score information and detailed background characteristics to remove the bias resulting from self-selecting into particular schools and/or fields of study. We find that the substitution of school-based learning for a work-based learning experience (of moderate length) can positively affect cognitive and non-cognitive skills in programmes with a greater emphasis on preparing students for the transition to the labour market. For programmes with an emphasis on higher education, on the other hand, (an increase in) workplace-based learning is consistently found to affect cognitive and non-cognitive educational outcomes in a negative way.

Keywords. education attainment, educational outcomes, foundation skills, literacy, numeracy, skill development, upper-secondary education, vocational education, technical education, fixed effects model.

JEL classifications. I21, I26, C33.

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1 Introduction

With youth unemployment rates continuously and largely surpassing the total unemployment rates in OECD countries (OECD, 2019), the topic of how education should prepare youth for the labour market is a hotly debated topic in the literature. Within the context of secondary education, much of this discussion centres around the question whether programmes should be either vocationally or generally oriented (Eichhorst, Rodríguez-Planas, Schmidl, & Zimmermann, 2015; Ryan, 2001; Verhaest & Baert, 2018). Multiple studies indicate that vocational programmes, especially those that include workplace learning based on apprenticeships or internships, are associated with smoother transitions to the labour market in comparison to more general programmes in secondary education (Arum & Shavit, 1995; Müller & Gangl, 2003; Neyt, Verhaest, & Baert, 2019, 2020). While this advantage for workplace-based programmes may be attributed to multiple factors, the most prominent explanation that is usually put forward is that workplace learning may allow one to develop social and professional skills that are directly applicable on the labour market.[1] Moreover, apart from improving directly one's labour market outcomes, some evidence also suggests an indirect effect through reducing drop-out and improving one's chances to obtain a qualification (Bishop & Mane, 2004; Polidano & Tabasso, 2014; Dougherty, 2018; Neyt et al., 2019). These results suggest that workplace learning may also increase students' non-cognitive outcomes like student's motivation, engagement and self-esteem.[2]

Despite these advantages, more recent evidence points to two main risks when school-based learning is substituted for workplace learning. A first risk is related to the employability of individuals in the long run. Several studies indicate the advantageous labour market outcomes of workplace-based programmes to diminish over time (Brunello & Rocco, 2017a; McIntosh, 2006; Neyt et al., 2019, 2020) and to turn even into disadvantages later in the career (Forster, Bol, & Van de Werfhorst, 2016; Hampf & Woessmann, 2017; Hanushek, Schwerdt, Woessmann, & Zhang, 2017; Lavrijsen & Nicaise, 2017;

[1] This explanation, which is in line with human capital theory (Becker, 1964), is sometimes complemented with other explanations based on signalling or networking. In line with signalling theory (Spence, 1973), these work experiences may allow students to signal motivation and other pre-existing social and professional abilities. Moreover, these experiences may enlarge one's professional network (Granovetter, 1973), making students more aware of potential labour market opportunities.

[2] There is now ample of evidence illustrating the importance of these non-cognitive outcomes both for educational (Borghans, Meijers, & Ter Weel, 2008; Dohmen, Falk, Huffman, & Sunde, 2010; Lleras, 2008) and labour market outcomes (Heckman & Rubinstein, 2001; Heckman, Stixrud, & Urzua, 2006; Heineck & Anger, 2010; Lindqvist & Vestman, 2011; Lleras, 2008).

Verhaest, Lavrijsen, Van Trier, Nicaise, & Omey, 2018). This outcome is frequently linked to the idea that the focus on specific skills may come at the expense of the acquisition of more general skills like numeracy, literacy and abstract thinking (Gamoran, Raffe, & Rosenbaum, 1998). Unlike these general skills, more specific skills are likely to be prone to skill obsolescence (Hanushek et al., 2017). Moreover, a lack of key cognitive skills may hinder individuals' ability for lifelong learning (Weber, 2014; Tobback, Verhaest, Baert, & De Witte, 2020). A second risk is related to the impact of a vocational focus in secondary education on the transition to and academic outcomes in higher education, which a few recent studies found to be negative (Holm, Jæger, Karlson, & Reimer, 2013; Polidano & Tabasso, 2016; Zilic, 2018; Neyt et al., 2019). Also, this may be explained by a reduced acquisition of key cognitive skills when more general school-based learning is substituted for learning at a workplace.

This paper contributes to this debate by examining whether the substitution of time devoted to school-based learning by time devoted to workplace-based learning affects cognitive and non-cognitive outcomes in secondary education. Differences in these cognitive and non-cognitive outcomes are presumed to be key mechanisms underlying the positive and negative effects of workplace learning on educational and labour market career outcomes. However, whether this is the case has barely been tested yet. While several studies found individuals with a vocational degree to score lower on numeracy and literacy than individuals with a general degree (Becker, Lüdtke, Trautwein, Köller, & Baumert, 2012; Retelsdorf, Becker, Köller, & Möller, 2012; Brunello & Rocco, 2017b; Guill, Lüdtke, & Köller, 2017; Dockx, De Fraine & Vandecandelaere, 2019),[3] this should not necessarily be attributed to workplace-based learning itself as many vocational programmes may be rather school-based. Moreover, these effects may also be attributed to tracking effects rather than effects of vocational education per se, as courses in vocational programmes may be made less challenging to cater to less-able students. Recent findings of Rasmusson, Albæk, Lind and Myrberg (2019) are more indicative in this respect, as they found the negative association between Vocational Education and Training (VET) and cognitive skills to be stronger in the context of an apprenticeship system (relative to a more academic vocational education). However, their conclusion was based on a comparison between a few countries and cohorts, and may, therefore, be driven by other contextual factors or by selection on pre-existing skills. Also for non-

[3] Kuzmina and Carnoy (2016), meanwhile, did not find evidence on differences in cognitive outcomes.

cognitive outcomes, the evidence usually focusses on the vocational-general divide rather than on the effects of workplace learning per se. For instance, Allan (2015) found that disaffection with learning (in girls) may be reduced through vocational learning, while Yu and Kelly (2019) found resilience and self-control to be positively impacted by vocational schools. Kelly and Price (2009), meanwhile, found no evidence on an impact on student effort, sense of belonging, locus of control or academic self-concept.[4]

With our analysis, we provide more direct evidence on the impact of the substitution of school-based for workplace-based learning on cognitive and non-cognitive outcomes. Moreover, by combining an analysis on cognitive and non-cognitive outcomes for the same group of students, our paper delivers a more comprehensive picture of the mechanisms underlying their relative effects on educational and labour market success. To this end, we take advantage of longitudinal test score data among Flemish (Belgian) secondary education students on key cognitive skills like numeracy and reading comprehension, and non-cognitive outcomes like student motivation, engagement, academic self-concept and well-being. Moreover, by comparing programmes with different doses of workplace-learning within similar vocational programmes in the same field of study and the same school, we are able to disentangle explicitly the impact of workplace-based learning from other aspects of vocational programmes. The Flemish context of secondary education is particularly interesting as it allows us to test and compare the impact of workplace learning within two different tracks of vocational education: the (pure) vocational track and the technical track. While the vocational track includes programmes that are alike to vocational programmes in other countries, the technical track is meant to provide a more balanced mix between vocational and general courses and is aimed at preparing students both for a transition to the labour market and to higher education. Therefore, we expect the substitution of time devoted to school-based learning for time devoted to workplace-based learning to have a stronger (negative) effect on key cognitive skills in the latter track than in the former track.

The remainder of the paper is structured as follows. First, we sketch the Flemish institutional context. Next, we present our data and outline our estimation strategy. Thereafter, we present our results. We end with a discussion and conclusions.

[4] Several older studies suggest a negative relationship between vocational education and these non-cognitive outcomes (Malmberg & Trempala, 1997; Van Houtte, 2005; Van Houtte, Demanet, & Stevens, 2012). However, these results were based on analyses that usually account for a limited set of controls and can, therefore, not be given a causal interpretation.

2 Institutional setting

Flemish secondary education comprises six or seven school years ("grades"), usually starting from age 12 onwards and ending at age 18 (the compulsory age of education) or 19. In grade seven and eight, which are the first two years of secondary education,[5] students participate in a broad educational programme. Thereafter, students enrol in one of the following four tracks: the general track, the art track, the technical track, and the vocational track. While the general track is meant to prepare for participation in higher education and the vocational track primarily prepares for the labour market, the technical and the art track are meant to offer students both options afterwards.[6] Moreover, while students from the technical track gain access to both professional and academic higher education after grade twelve, those in the vocational track only obtain access after having finalised a thirteenth grade.

The technical and vocational track include a similar number of fields of study (23 and 21 respectively), which each are further subdivided into one or more subfields. A large part of the fields of study is provided in both tracks (e.g. construction, trade, wood or tourism), although they may differ somewhat in the offered subfields. For instance, in grade eleven and twelve, the field of study 'trade' comprises four subfields for the technical track (accounting informatics, trade, computer management, and secretary-languages), and two subfields for the vocational track (office and sales). From grade seven to grade eleven, students may change (sub)fields and tracks after each grade, although their options depend on their track and evaluation in the previous academic year. In contrast, between grade eleven and twelve, students are obliged to remain within the same subfield (Flemish Government, 2002).[7]

From grade ten onwards, programmes may include work-based learning experiences, which are called internships in the official terminology ("Leerlingenstages, Observatieactiviteiten en Praktijklessen," 2015). From age 16 onwards, students may also opt for a dual vocational or technical programme, in which they combine learning at an educational institution for several days a week with learning at a workplace as an apprentice. These dual programmes are relatively new and, up until now, less frequently

[5] Throughout the paper, we will refer to each year of secondary education as a grade; e.g. grade seven represents the first year of secondary education and the seventh year taking the first year of primary education as starting point. While defining a grade as one year of instruction aligns with the definition that is used in the international literature, it deviates from the official definition in Flanders which includes two years of instruction.

[6] As we focus on the effect of internship experience during full-time school-based secondary education, these individuals from the general and the art track are not included in our analyses.

[7] Only for serious medical, psychological, social or educational reasons, students may switch to a different subfield within the same field of study, conditional on a positive decision of the class board (Flemish Government, 2002).

chosen than the non-dual technical and vocational trajectories. Due to data availability, we focus in our analysis on the impact of internships within non-dual technical and vocational programmes. In general, workplace-based learning experiences within non-dual programmes are, compared to apprenticeships, under more strict control of the school (relative to the employer) and of a shorter duration. Moreover, while students usually participate in their apprenticeship every week for a couple of days, internships in non-dual programmes are more frequently concentrated within a particular period. Finally, students in dual programmes usually participate in an apprenticeship at the same organisation across the school years, while workplace-based learning based on internships is usually spread over different organisations.

Within the non-dual technical and the vocational tracks, the inclusion of a work-based learning experience in the curriculum of non-dual programmes became mandatory in 2013 ("Codex Secundair Onderwijs," 2011). The prescribed length of this experience is a minimum of eighteen half school days each school year, with a maximum of 1200 hours per school year.[8] However, as this policy had to be implemented gradually in the programmes, we still observe many programmes without this experience, especially within the technical track and in the fifth year of full-time secondary education. Moreover, the amount of workplace-based learning largely differs across fields and subfields of study, and also schools have some discretion about how many hours of workplace-based learning are included in the curriculum.

3 Methodology

3.1 Data

Our analyses rely on data from the longitudinal LiSO (Dutch acronym for "Educational Trajectories in Secondary Education") dataset. This data collection is based on repeated surveys and tests among a cohort of secondary education students in 48 Flemish schools. LiSO adopted a regional sampling strategy, such that almost all students from full-time secondary education belonging to the aforementioned cohort in all 48 schools within a certain geographical area are included. Although this sampling strategy may introduce a regional bias, the sample provides a comprehensive overview of students in secondary education as it includes both urbanised communities (i.e., Mechelen and Vilvoorde) and more rural

[8] Students spent at least half a school day and at max a full school day (eight hours) per day at the workplace. The work-based learning experiences may or may not be consecutive ("Codex Secundair Onderwijs," 2011).

communities surrounding the city of Mechelen. Also elaborate descriptive statistics, provided by LiSO, reassure us that the regional sample is similar to the entire population of students in Flemish secondary education (Stevens et al., 2015).

The LiSO data has two major assets. First, it comprises ample information on students' cognitive and non-cognitive educational outcomes. Within the LiSO framework, students were queried and tested on most of these outcomes at the end of each grade, with grade seven being tested in 2014 and grade twelve being tested in 2019. The querying and testing at the end of each grade were subdivided in two separate test rounds, one taking place after the spring break and focussing on the students' non-cognitive outcomes, and another one taking place after the Easter break and focussing on their cognitive outcomes. Second, it includes detailed background information of the student, the family and school environment, based on several linked surveys among the students, parents, teachers, and the school board. The student background questionnaire, our main source of background information, was administered on paper each year in de classroom under the surveillance of the teacher. The parent(s) questionnaire was administered once, either at the start of secondary education or, for those parents who did not participate in this wave, in the subsequent year(s).

3.2 Dependent and independent variables

3.2.1 Work-based versus school-based learning

Through an additional questionnaire, administered at the same time as the numeracy test in grade twelve, students from the vocational and technical non-dual programmes reported the total number of hours of work-based learning scheduled during the school year.[9] Additionally, they had to indicate the number of hours of workplace learning that they already participated in at the time of the survey. As the student questionnaire, the numeracy test, and the reading comprehension test had to be administered at different time points and, as the start and end date of the workplace experiences are unknown, we look at the impact of the amount of workplace-based learning that is scheduled for the full school year. Moreover, rather than looking at the impact of the individually reported number of weeks of workplace learning, we look at the impact of the median number of weeks reported within one's programme, with the latter

[9] These hours encompass all hours spent at the workplace and do not include travel time to the workplace.

being defined as a school-subfield combination. Although the official amount of workplace-based learning in one's curriculum should be the same for each student that participates in the same programme, we still observe variation within each programme in the number of reported weeks. This may be explained by two main issues. A first issue arises from reporting errors, leading to a bias towards zero of the estimated effects in case we would rely on the individual reports. Second, the student may not comply with the curriculum, for instance, because the school did not manage to find an internship of sufficient length or because (s)he worked (informally) more hours than stipulated in the contract. This complicates the interpretation of the estimated effects based on individual reports as more time spent on workplace-based learning would not necessarily reflect less time spent on school-based learning in this case. Moreover, it may also lead to problems of reversed causality in case finding no internship (of sufficient length) leads to frustration and reduced motivation. Therefore, we prefer to rely on the amount of workplace learning at the level of the programme for our main analyses and merely present the results based on the individual reports as a robustness check. Furthermore, as we only have information on work-based learning during grade twelve, our analyses focus on the outcomes measured in 2019.

In our sample, we observe a clear distinction between students from the vocational track and the technical track (see Table 1). While almost all students (99.8%) from the vocational track are in a programme with a curriculum that includes workplace-based learning, this is the case for only about 43.6% of the students from a technical track. There is also a marked difference between the two tracks in the average number of weeks of workplace-based learning that is officially scheduled in the curriculum of one's programme. While the conditional number of weeks is 4.1 for the full sample, this is 2.4 and 6.1 weeks for the technical and vocational track respectively.[10] A back-of-the-envelope calculation suggests this to be equivalent to about 12.8% of the total learning volume (32 weeks per school year)[11] for the full sample, and 7.5% and 19.1% for the technical and vocational track respectively. However, as the number of weekly class hours is lower (between 28 and 36) than the number of hours at a workplace (38) and as one class hour represents 50 minutes only, these percentages represent a lower bound.

3.2.2 Cognitive and non-cognitive educational outcomes

[10] The number of weeks is calculated assuming a 38 hours working week.
[11] These 32 weeks exclude exam and deliberation periods.

While the numeracy test was administered in each school year, the reading comprehension test was not provided to students at the end of grade eleven. Students' numeracy and reading skills are measured using tests with a timeframe of 50 to 100 minutes. The attainment targets and development goals of secondary education form the starting point of these tests.[12] For numeracy, each year the students are queried about their knowledge of and capabilities for algebra, data and information processing, arithmetic,[13] theory of numbers,[14] geometry, and, for later years, functions. For each student, an overall numeracy test score on these six elements is generated. For reading comprehension, students are provided with various types of texts, including fictional texts, informative texts, instructions, and diagrams. These texts were assigned a difficulty level based on the length (short versus extensive), structure (simple versus complex), formulation (simple versus complex), visual aids (a lot versus none), familiarity with the subject (little versus a lot), and style (abstract versus concrete). For each text, students are queried about the meaning of text elements, the relationships between text elements, the author, and formal aspects of the text (e.g. layout, relationship between verbal and non-verbal elements). The reading test score represents the overall score of the student on the various text types. LiSO provides for each test (numeracy and reading comprehension) a Weighted likelihood estimates (WLE) ability score,[15] allowing researchers to compare scores over multiple test versions (e.g. over different tracks and multiple years). In Table 1, we report descriptives on these outcomes measured at the end of grade twelve. For our analysis, we standardise these outcomes based on the corresponding mean and standard deviation for the full sample of students from both technical and vocational tracks in grade twelve.

In addition to the two cognitive outcomes, we include four non-cognitive educational outcomes in our analysis; motivation, engagement, well-being at school and academic self-concept. All non-cognitive outcomes were surveyed using a five-point Likert-scale, where 1 means 'untrue', 2 means 'mostly untrue', 3 means 'sometimes untrue, sometimes true', 4 means 'mostly true' and 5 means 'true'. All outcomes are displayed in Table 1 (the individual items are listed in Appendix A1). In our analyses,

[12] Other sources of information are the curricula and the most frequently used textbooks for the corresponding grade.
[13] Knowledge of standard units of measure of length, weight, time, etc., and using that knowledge to solve concrete problems.
[14] Ability to interpret verbal statements through knowledge of terms, concepts, symbols and an understanding of the numerical system.
[15] These ability scores are calculated by LiSO, and result from extensive Item Response Theory (IRT) analyses.

we rely on the standardized mean of the students' responses to the items covering a particular concept. Cronbach alphas range from .658 (emotional disengagement) to .865 (well-being at school).[16]

The first non-cognitive outcome, which is *motivation*, measures why students do their best at school. Based on the Academic Self-regulation Questionnaire (Ryan & Deci, 2000a, 2000b), the concept differentiates between autonomous motivation, controlled motivation and amotivation (-). These three concepts query the different driving forces to learn. While students who score high on autonomous motivation have a clear intrinsic motivation to learn e.g. "I try my best at school because I want to learn new things," students who score high on controlled motivation try their best to please others or avoid negative consequences (extrinsic motivation) e.g. "I try my best at school because others expect me to". Conversely, those who score high on amotivation overall don't know why they (would) try their best: "Why do you try your best at school? I don't know why, I don't see what difference it makes".

The second non-cognitive outcome *engagement* emphasizes students' constructive, focused, and enthusiastic participation in class. The outcome draws on (a reduced version of)[17] the theoretical framework of Skinner, Kindermann, and Furrer (2009). The framework distinguishes engagement from disengagement, and behavioural features from emotional features. The former features relate to students' behaviour in class or lack thereof, e.g. participation in class discussions. The latter features cover the students' feelings in class (positive or negative). These two subdivisions lead to four concepts, each comprising four to six statements, namely behavioural engagement e.g. "When I'm in class, I participate in class discussions", behavioural disengagement (-) e.g. "When I'm in class, I just act like I'm working", emotional engagement e.g. "When we work on something in class, I feel interested", and emotional disengagement (-) e.g. "When I can't answer a question, I feel frustrated".

The third non-cognitive outcome, *student's well-being*, is based on previous research of Smits and Vorst (2008). It captures how a student feels at school and expresses the socio-emotional attitude of students towards life as a student (Mertens & Van Damme, 2000). The scale comprises nine statements among which "If I could choose, I'd rather go to another school (-)".

[16] Note that all but one Cronbach alpha surpass the standard threshold of 0.7.
[17] The items are translated to Dutch by Verschueren and Wouters (2012).

Finally, *academic self-concept* is used to refer to how someone thinks about, evaluates or perceives their academic achievement. Contrary to hard cognitive outcomes, this relates to students' perceptions on success, grade averages, and how they navigate different subject areas: e.g. "I'm good at most school subjects". The items in this scale are drawn from Self-Description Questionnaire II short-form (SDQII-S) (Marsh, Ellis, Parada, Richards, & Heubeck, 2005).

< Table 1 about here >

3.3 Sample

The LiSO data include observations of in total 6,165 grade twelve students in the general, technical and vocational tracks. As our analyses focus on the substitution between school-based learning and work-based learning on outcomes measured in 2019, we exclude (i) 2,732 students from the general and art track as these students do not have work-based learning in their programme, (ii) 1,020 students from a technical or vocational track for whom we have no information on their work-based learning experience in grade twelve,[18] (iii) 798 students for whom the background characteristics are unknown, and (iv) students for whom we have no information on their analysed (non-)cognitive outcome in grade eleven.[19] The number of observations dropped due to the latter condition depends on the analysed outcome, but averages around 111 dropped observations. Additionally, students who experienced grade retention during secondary education are not included in the sample as they have not yet reached grade twelve in school year 2018-2019. Our final sample consists of 1,615 students, of which 1,176 were enrolled in a technical track and 439 in a vocational track.[20]

3.4 Identification strategy

To study the impact of work-based learning on students' cognitive and non-cognitive outcomes, we estimate several regression models that take the following general form:

[18] Out of the 1,020 students, 398 students did not participate in the survey on workplace-based learning, and another 548 students did not fill out the survey question(s) related to work-based learning; 74 observations were dropped due to inconsistent and erroneous data. The (non-)cognitive test score outcomes are relatively similar between the students for whom we have information on their work-based learning experience and the excluded students (see Appendix A2).
[19] As an exception for reading comprehension test score we adopt the analysed score in grade ten.
[20] Some descriptive statistics on the sample are provided in Appendix A3.

$$Y_{isf} = \beta_1 + \beta_2\, WBL_{isf} + \mathbf{X_{isf}\beta_3} + \varepsilon_{isf}$$

where Y_{isf} is the standardised (non-)cognitive educational outcome in grade twelve of student i in school s in field of study f. The impact of work-based learning is estimated by including WBL_{isf}, which is equal to the number of weeks of work-based learning that is standardly included in the student's programme of grade twelve. Further, $\mathbf{X_{isf}}$ represents a vector of control variables that differs in composition depending on the specification. Finally, ε_{igs} represents the error term. Since we expect the effects to differ between students from the technical and those from the vocational track, we run separate models for these two groups. For the ease of interpretation, all models are estimated based on linear regression (cf. Angrist and Pischke, 2008). To account for the grouped nature of our independent variable, standard errors are corrected for clustering at the school and the field of study level.

Students with a lower or higher performance throughout their secondary education trajectory might self-select into programmes with higher or lower levels of workplace-based learning. This selectivity is accounted for in our analysis in three main ways. First, we add fixed effects for groups of students that participate in the same field of study in the same school (i.e. school-field-of-study combination) to remove the bias resulting from self-selecting into particular schools and/or fields of study that differ in terms of quality and difficulty. By doing so, we exploit two types of remaining variation. [21] First, there is remaining variation in the officially recommended number of weeks of workplace-based learning within fields of study, but across subfields. Second, schools have some freedom in how they translate these recommendations to each of the programmes they offer. Our sample comprises 44 schools and 17 fields of study. The combination of both results in 125 units, with each unit including, on average, 2.6 classrooms.[22]

Also within fields of study within schools, there might be some selectivity as students with particular characteristics might be more or less likely to choose for subfields with more weeks of workplace learning. Therefore, as a second strategy to deal with selectivity, we exploit the longitudinal

[21] A graphical depiction of the residual variance in (weeks of) work-based learning before and after adding (school-field-of-study combination) fixed effects is provided in Appendix A4. This graphical depiction illustrates that, while this residual variance in work-based learning is reduced when the fixed effects are added, it remains substantial enough to identify potential effects.

[22] Note that, as the remaining variation in workplace-based learning is situated at the level of the programme (which is the same for all students within a subfield within a school) and as all students within a class usually participate in the same programme, we cannot rely on programme or class fixed effects.

nature of our data by including also the standardised score for the (non-)cognitive outcome of the student in grade eleven as control variable.[23] In that way, we measure the realized value-added in terms of these outcomes rather than their levels and account for average differences in initial levels of (non-)cognitive outcomes between programmes within school-field-of-study combinations. Note also that, although there is a time gap of a few months between the measurement of the outcome in grade eleven and the start of grade twelve, it is not allowed to change one's subfield between grade eleven and twelve. Therefore, except by changing school between these grades, students cannot endogenously change the number of weeks of workplace learning in their programme in response to a shock in the outcome variable after its measurement in grade eleven but before the start of grade twelve.

While the addition of the (non-)cognitive outcome in the previous grade is likely to capture most of the remaining selectivity within school-field-of-study combinations, we cannot exclude there to be some remaining heterogeneity that is orthogonal to the outcome in the previous grade and that affect both one's participation in programmes with workplace-based learning and one's (non-)cognitive outcomes in grade twelve. Therefore, as a third way to account for selective entrance in programmes with various levels of workplace learning, we also include a large range of background characteristics. These characteristics are dummies for gender, language spoken at home by both parents, parents' country of birth, whether the parents are divorced, parent's highest degree obtained, occupation of the parent, and the number of books at home.

A remaining concern may be that students and parents select schools based on the inclusion of work-based experiences in grade twelve. However, for three main reasons, we do not believe this to be an issue in the context of our analysis. First, in the context of Flemish vocational secondary education, initial school choice is primarily driven by whether the school is Catholic or public and by its geographical location (proximity to the residence) (Creten, Douterlungne, Verhaeghe, & De Vos, 2000).[24] For instance, 65% of all students travel fifteen minutes or less (Janssens, Paul, & Wets, 2020). The potential problem of self-selection in schools is thus largely related to the number of schools within a limited area around

[23] Grade ten for our analyses for reading comprehension.

[24] Also perceived quality and the pedagogical approach are important factors, but primarily for students enrolling the the general track (Creten et al., 2000); while the former factor primarily depends on the parents' assessment of whether a secondary school offers a good preparation for higher education, schools with alternative pedagogical approaches primarily offer programmes in the general track.

the student's residence that have the same religious domination (i.e. Catholic or public) and that offer a programme in one's preferred field of study. Even within the urbanised community of Mechelen, this implies that, for a given field of study, often only one or two school are can be considered in the school choice. Second, research suggests that, in Flanders, also the students' main motivations to change schools during secondary education are unrelated to specific characteristics of the curriculum (Craessaerts, Timmermans, Valgaeren, & Verhas, 2015).[25] Third, while general information about the curriculum of each (sub)field of study can freely be accessed online, the provided curriculum information usually does not include more detailed information on work-based learning.[26]

4 Results

4.1 Cognitive educational outcomes

We first report the results on the impact of the amount of work-based learning in grade twelve on students' cognitive outcomes (see Table 2). We present the results on four specifications, starting with a model without any controls (Model 0), and gradually adding the school-field-of-study fixed effects (Model 1), the (non-)cognitive outcome in the previous year (Model 2) and, finally, also the detailed background characteristics (Model 3). To maximize comparability, each model is estimated based on the same sample that excludes observations with missing values on the background characteristics and on the outcome in the previous year.

For the technical track, workplace-based learning is consistently found to affect the numeracy test score in a statistically significant negative way. Based on Model 0, that does not include any controls, a one week increase in work-based learning in the curriculum is predicted to lead to a 7.1% standard deviation (SD) decrease in the numeracy score. Moreover, the estimated negative effect becomes even larger as school-field-of-study fixed effects are included in the model, suggesting that students in schools and fields of study with, on average, a larger number of weeks of workplace learning attract better-performing students. Finally, while the estimated negative effect again becomes smaller once also the

[25] These main motivations are that the initial school does not provide the desired (sub)field of study and bullying.

[26] Often only a broad range of hours devoted to work-based learning (e.g. 4 to 8 hours of the 36 course hours per week) is indicated in the online curriculum.

numeracy score in the preceding grade and the background characteristics are added, the estimate remains strongly statistically significant and still well exceeds the estimate based on the model without controls. Based on our preferred and most complete specification (Model 3), the estimated negative effect is 9.8% of a SD for one week of workplace-based learning. Translated to an average number of 4.1 weeks of workplace learning in the curriculum among those with a programme that includes workplace learning,[27] this leads to a moderate reduction in the students' numeracy score of about 40.2% (-.098x4.1) of a SD.[28]

For the vocational track, we find a relatively small and statistically insignificant positive effect of workplace-based learning on the numeracy score based on our initial model (Model 0). However, once the controls are added, the effect becomes negative and statistically significant. Based on Model 3, the predicted decrease of the numeracy score for one week of work-based learning is about 9.4% of a SD, which is close to the effect for the technical track.

Regarding students' reading test scores, the conclusions differ more substantially between the two tracks. In line with the results on numeracy, the results suggest a negative effect for our sample of students from the technical track. Based on Model 3, that includes all controls, we find one week of work-based learning to lead to a small reduction in reading scores by about 6.4% of a SD (compared to a reduction by 9.8% for numeracy). For vocational students meanwhile, we do not observe any statistically significant effects of workplace-based learning on reading scores.

< Table 2 about here >

4.2 Non-cognitive educational outcomes

Next, we examine how work-based learning affects non-cognitive outcomes as potential mechanisms underlying the educational and labour market career outcomes (see Table 3). With regards to motivation, the conclusions clearly differ depending on the type of track and the type of motivation that is considered. For the students of the technical track, we find a negative effect of workplace-based learning on autonomous motivation once we control for school-field-of-study fixed effects (Model 1, 2 and 3). The

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[27] This estimate thus reflects the effect of a workplace learning experience of average duration. A difference of 4.1 weeks also approximately reflects the interquartile range in the unconditional number of weeks of workplace learning (4.3 weeks).
[28] To put these numbers into perspective, we compare them to the effect sizes in the pivotal work of Hattie (2009) on the influences on achievement in school-aged students. In his book, Hattie assesses an effect size of 0.2 as small, 0.4 as moderate, and 0.6 as strong. (These three categories are adopted in the remainder of the result section.)

estimated decrease in autonomous motivation of one week of workplace-based learning is equal to 7.1% of a SD (Model 3); this is equivalent to a small reduction of 29.1% (-.071x4.1) of a SD for a conditional average workplace-based learning experience of 4.1 weeks. For the students of the vocational track meanwhile, the picture is more nuanced as a negative effect on controlled motivations is found to be combined with a negative effect on amotivation once selectivity is accounted for (Model 1, 2 and 3). Moreover, the estimated effect on the latter outcome is strong; based on Model 3, the estimated reduction in amotivation is about 84.5% (-.206x4.1) of a SD for a conditional average workplace-based learning experience of 4.1 weeks.

For engagement, the results more clearly reflect those on the cognitive outcomes. For the technical track, we consistently find work-based learning to lead to a decrease in engagement and an increase in disengagement. Moreover, the estimated effects are, again, larger when we control for school-field-of-study fixed effects. Based on Model 3, the estimated effect of one week of work-based learning on emotional engagement (disengagement) is equal to -9.2% (+7.4%) of a SD. For a conditional average number of weeks of workplace-based experience, this is equivalent to a small effect of -38.6% (+31.1%) of a SD. Also for students from the vocational track, an adverse effect emerges albeit only in terms of increasing behavioural disengagement. Based on Model 3, the estimated increase in behavioural disengagement of one week of workplace-based learning is equal to 14.0% of a SD; for a conditional average number of weeks of workplace-based learning, the estimated effect is moderate and equals 57.4% (.140x4.1) of a SD. Remarkably, when selectivity is not accounted for (Model 0), the results are usually more favourable for engagement; this indicates that those with more workplace-based learning in the vocational track are a positively selected group in terms of this non-cognitive skill.

Also the results on students' well-being, the third non-cognitive outcome we consider, suggest some negative effect of workplace-based learning for students of the technical track. The estimated effect, based on Model 3, is equivalent to a small reduction in well-being of 24.6% (-.060*4.1) of SD when the curriculum of the students includes a workplace-learning experience of average conditional duration. The estimated effect on students' well-being in the vocational track meanwhile, is statistically insignificant. Finally, neither for the technical nor for the vocational track do our results indicate any effect on students' general academic self-concept.

< Table 3 about here >

4.3 Sensitivity and robustness analyses

We check the sensitivity and robustness of our results in various ways. First, while we already accounted in a detailed way for the potential non-random selection into programmes with workplace-based learning, we cannot exclude there to be some remaining student heterogeneity that affects both the programme participation and the outcomes. In Table 4, we report the results of three robustness analyses that check whether this is indeed an issue. In Column A, we add all cognitive and non-cognitive skills in grade eleven as control variables (and not only the (non-)cognitive skill that is analysed as outcome in the regression). In Model B, we add the analysed (non-)cognitive outcome at the start of grade seven as an additional control variable. Finally, in Model C, we adopt a Coarsened Exact Matching (CEM) estimator that match technical students with over 2.430 median number of weeks of workplace-based learning reported within one's programme with students with less or no work-based learning experience in their programme based on their background characteristics.[29]

For the technical track, the conclusions remain largely unaffected. Only for student well-being and this only in the case of robustness analysis B, the estimate loses its statistical significance. The results regarding the vocational track meanwhile are somewhat less stable. While the estimated effects on numeracy scores and behavioural disengagement become statistically insignificant in case of analysis A, the estimated effect on controlled motivation becomes statistically insignificant in case of analysis B. Note however that the precision of these estimates is substantially lower in comparison to those in the benchmark analysis, probably due to strongly reduced sample sizes as a consequence of missing values. Moreover, the estimated effect on amotivation for the vocational track remains negative and strongly significant in all cases. Overall, this does not indicate the main conclusions based on the benchmark analysis to be driven by remaining student heterogeneity.[30]

< Table 4 about here >

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[29] 2.430 is the average number of median weeks of workplace learning within one's programme among those with technical programme that includes workplace learning.

[30] Additional tests did not indicate the estimates based on Model A (Table 4) to be statistically significantly different from those based on Model 3 in the benchmark analysis (Table 2 and 3), except for technical students' (dis)engagement. These results are available upon request.

Second, as the inclusion of the school-field-of-study combination fixed effects removes a large part of the variation, this may have led to a reduced efficiency of our estimates. Therefore, we re-estimate our analyses with only school-level fixed effects or field of study-level fixed effects, instead of a combination of both. Overall, this does not lead to more precise estimates (see Appendix A5). On the contrary, some of the estimates turn insignificant when school-level fixed effects are not accounted for and, in most cases, the absolute value of the estimated effects become smaller. This demonstrates the importance of adding these combined fixed effects as controls to account for the selection bias.

Third, both for the cognitive and non-cognitive outcomes, we used multiple indicators to test our hypotheses and the estimated effects were not always statistically significant. Therefore, it is likely that the significance for some of these indicators results from multiple testing and is, therefore, merely accidental. To test whether this may explain our outcomes, we conduct a Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995), which assesses the influence of multiple testing for each effect individually (see Appendix A6). However, the outcomes of this procedure do not affect our conclusions regarding any of the outcome indicators and for none of the two tracks.

Fourth, we assumed a linear relationship between the number of weeks of workplace-based learning and the (non-)cognitive outcomes in our benchmark model. We conduct a number of sensitivity analyses in this respect based on the following alternative specifications: (A) a model that also includes a quadratic term for the number of weeks of workplace-based learning, (B) a model in which the number of weeks of workplace-based learning is log-transformed and, (C) a model based on a dummy that measures whether the programme includes any workplace-based learning (estimated only for those in the technical track). As shown in Appendix A7, Model (B) and (C) do not alter our conclusions based on the benchmark analysis. However, the results on Model (A) suggest the effect to be nonlinear in some cases. The results on those outcomes for which a nonlinear effect is detected are reported in Table 5 (see Appendix A7 for the full set of results). With respect to the technical track, we find the negative (positive) effect of additional workplace-based learning on numeracy, autonomous and emotional engagement (behavioural disengagement) to decline as the amount of workplace-based learning increases. A back-of-the-envelope calculation suggests the accumulated effects to reach their maximum at 5.2 weeks (in the case of behavioural disengagement) to 8.4 weeks (in the case of emotional disengagement) of workplace-based learning. Note, however, that these estimated maxima are well above the conditional average number of 2.4 weeks of workplace-based learning within the technical track. For those in the vocational track, meanwhile, our estimates suggest the initial effects on numeracy, reading and behavioural engagement to be rather positive. However, the accumulated effects are estimated to reach their maximum for these outcomes at 4.0, 5.3 and 4.6 weeks respectively, which is below the conditional average number of 6.1 weeks of workplace-based learning within the vocational track. Moreover, in the case of numeracy, the accumulated effect is estimated to become negative after 7.9 weeks.

< Table 5 about here >

Next, except for numeracy, we do not observe the exact number of weeks of workplace learning in the curriculum of one's programme that was scheduled up to the date we observed the outcomes. Therefore, we relied on the number of weeks within the curriculum of one's programme for the full school year, with the volume of workplace-based learning relative to school-based learning up to the time of the observation of our outcomes being presumed to be proportionate to the volume of workplace-based learning relative to school-based learning for the full school year. Indeed, the correlation between the number of weeks up to the time of the numeracy test and the total number of weeks in the school year, which is 97.5%, illustrates that this assumption is approximately true. Nonetheless, we re-estimate our models for numeracy by relying instead on the number of weeks up to the date of the numeracy test (Table 6, Column A). Based on this alternative indicator, the estimated effect for the vocational track is no longer statistically significant. However, the size of the estimated coefficients is, for both tracks, relatively similar to those in the benchmark analysis. Further, we re-analyse our data for the non-cognitive outcomes based on a subsample that excludes those students that filled out the survey before the Easter break (Table 6, Column B). This means that most students will have started their work-based learning experience already at the time of the measurement of the (non-)cognitive outcomes. Also these results are largely equivalent to those in the benchmark analysis. The only exception is the estimated negative effect on emotional disengagement in case of the vocational track, which is now weakly statistically significant ($p<.10$).

< Table 6 about here >

Finally, we relied on the number of weeks of workplace learning at the programme level rather than the reported number of weeks at the student level. As argued, the reported number of weeks at the student level may less clearly reflect a trade-off between workplace- and school-based learning, and they may also be more prone to problems of measurement error and reversed causality. To check whether this decision affects our conclusions, we also report estimates relying on the number of weeks at the student level (Table 6, Column C). Several key findings related to the technical track, such as the negative impact of workplace-based learning on numeracy, emotional engagement and well-being, are also found when relying on this alternative analysis. However, the estimated effects are usually less sizeable and become, in the case of the other outcomes, statistically insignificant. Moreover, for the vocational track, the results are relatively more positive when relying on the student-level indicator. While the estimated effect on numeracy becomes statistically insignificant, we find a positive impact on autonomous motivation, behavioural engagement and emotional engagement based on this indicator. Overall, these less unfavourable (more favourable) findings for the technical (vocational) track are consistent with the aforementioned potential disadvantages of the student-level indicator. First, as more time spent on workplace-based learning may not for every student indicate less time spent on school-based learning, this is likely to lead to an underestimation of the negative impact of additional hours of work-based learning in the curriculum on cognitive outcomes. Moreover, it may explain the less (more) unfavourable (favourable) effects of the student-level indicator on non-cognitive outcomes if the inability to find an internship of sufficient length leads to frustration and reduced motivation. Second, it is consistent with the reversed causality explanation as students that experience a reduction in their motivation and other (non-)cognitive outcomes may on their turn be less likely to find an internship. Third, also bias towards zero of the estimated effects as a consequence of reporting errors may explain the divergence in outcomes, although this seems not to be the dominant explanation for some of the outcomes in the case of the vocational track.

5 Discussion and conclusion

In this article, we examined whether the substitution of time devoted to school-based learning by time devoted to work-based learning affects cognitive and non-cognitive outcomes. Taking advantage of longitudinal test score data among Flemish secondary education students and by comparing programmes with different doses of workplace-learning within vocational programmes in the same school and field of study, we disentangle the impact of workplace-based learning from other aspects of vocational programmes. Additionally, we test and compare the impact of work-based learning in two different tracks, a technical track which is aimed at preparing students both for a transition to the labour market and to higher education, and the pure labour-market oriented vocational track.

In line with the theoretical arguments put forward in the literature and the empirical findings in the literature on the effects of vocational education (rather than workplace learning per se), we found evidence on both negative effects on cognitive outcomes and positive effects on non-cognitive outcomes when school-based learning is substituted for workplace-based learning. However, the observed effects depend largely upon the track. For the technical track, we consistently found a larger emphasis on workplace-based learning to affect cognitive and non-cognitive educational outcomes in a negative way. In particular, it was found to reduce their numeracy and reading test scores as well as to reduce (increase) their autonomous motivation, engagement and well-being (disengagement). Moreover, for several of these outcomes, the effects seem to be moderate with effect sizes ranging from 40% to 57% of a SD. For instance, implementing a workplace-based experience of average duration was estimated to affect one's numeracy scores negatively by 40.2% of a SD.

For students of the vocational track meanwhile, the picture is much more nuanced. Although our baseline analysis suggested the average effect on numeracy and controlled motivation (behavioural disengagement) to be negative (positive) for these students as well, these results were not robust across all analyses. Moreover, additional tests indicated the effect on numeracy may even be positive for workplace-based learning experiences of moderate length (up to about four weeks of a school year) and a similar positive effect of these moderate workplace-based learning experiences was also found on reading comprehension and behavioural engagement. Finally, we consistently found a negative effect of workplace-based learning on amotivation (i.e. not knowing why one would try their best at school) in the vocational track. The latter effect was found to be strong, with the implementation of a workplace-based learning experience of average duration being estimated to reduce student's amotivation in the vocational track by 84.5% of a SD.

Overall, these findings are in line with the argument put forward in the introduction that the substitution of school-based learning for workplace-based learning is likely to have more (less) positive effects on cognitive and non-cognitive skills in programmes with a greater emphasis on preparing students for the transition to the labour market (higher education). Moreover, they are consistent with the explanations advanced in the literature about the mechanisms underlying the observed effects of workplace-based programmes on educational and labour market career outcomes. First of all, the reduction in cognitive skills found in technical programmes for any workplace learning and in pure vocational programmes for more substantial components of workplace learning aligns with many recent studies that found programmes with workplace-based learning to be associated with reduced long-run employability. Second, the reduction in cognitive and non-cognitive skills of workplace-based learning in the technical track is also consistent with the findings of a few more recent studies that a stronger vocational focus may reduce the transition to and academic outcomes in higher education. Finally, the strong reduction in amotivation among students in pure vocational programmes when the proportion of workplace-based learning is increased, is compatible with both the findings of reduced dropout rates in secondary education and increased initial employability levels among these students.

A major concern about these conclusions may be that they are biased due to non-random selection in programmes with workplace-based learning. However, information on detailed school-field-of-study effects, (non-)cognitive outcomes in the preceding grade, as well as a long list of background characteristics allowed us to account for this heterogeneity in a much more detailed way than many other studies on this topic. Moreover, our main conclusions were also robust to several additional checks, for instance by also controlling for the (non-)cognitive outcomes at even earlier ages or by adopting a Coarsened Exact Matching estimator. Finally, if any, our results suggested the estimated effects to increase even when student heterogeneity is accounted for. Therefore, we are confident that our main findings do not merely reflect correlations and can be given a causal interpretation. Still, as we were the firsts to address the issue of student heterogeneity in a more detailed way when analysing the effects of workplace learning per se, we are in favour of further research in this respect that adopts alternative identification strategies and that look whether our conclusions hold in the context of different countries and educational systems.

Besides these research implications, our research has major practical implications. When deciding on the substitution of school-based learning for workplace-based learning, policymakers and school boards are confronted with a complex puzzle where the direction and magnitude of the effect of work-based learning on (non-)cognitive outcomes largely depend on the type of programme in which school-based learning is substituted for workplace-based learning (track), the type of (non-)cognitive outcome that is considered and the amount of workplace-based learning that is implemented. Overall, our results suggest the effects to be more promising for moderate doses of workplace-based learning (up to about one month per school year) in pure vocational programmes and to be more detrimental when they are implemented in programmes that are also aimed at preparing for higher education. Still, these effects may depend on the content and quality of work-based experiences, and have to be traded-off against the potential benefits of workplace-based learning in terms of fostering the acquisition of more occupation-specific skills or professional skills, such as time management and interpersonal skills, issues on which no information was available in our data and on which further research is advised.

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Tables

Table 1. Descriptive statistics

Outcome	N	Mean (std.dev.)	Min.	Max.	Explanation
Work-based learning					
Dummy for work-based learning					
Full sample	1,615	.589 (.492)	0	1	Dummy for work-based learning reported in one's programme for all students
In technical track	1,176	.436 (.496)	0	1	Dummy for work-based learning reported in one's programme for students in the technical track
In vocational track	439	.998 (.048)	0	1	Dummy for work-based learning reported in one's programme for students in the vocational track
Median number of weeks					
Full sample	951	4.111 (2.745)	.211	12.632	Median number of weeks for all students with work-based learning
In technical track	513	2.430 (1.437)	.211	10.263	Median number of weeks for students in the technical track with work-based learning
In vocational track	438	6.079 (2.601)	.211	12.632	Median number of weeks for students in the vocational track with work-based learning
Cognitive educational outcomes					
Numeracy	1,504	104.150 (14.798)	38.783	142.719	Ability score for numeracy
Reading comprehension	1,381	84.469 (12.966)	37.664	126.188	Ability score for reading comprehension (Dutch)
Non-cognitive educational outcomes (Mean of students' responses)					
Motivation	1,364				
Autonomous motivation		3.379 (.808)	1	5	e.g. "I try my best at school because it's important to me"
Controlled motivation		2.871 (.830)			e.g. "I try my best at school because others expect me to"
Amotivation		2.137 (1.138)			"Why do you try your best at school? I don't know why, I don't see what difference it makes"
Engagement	1,379				
Behavioural engagement		3.469 (.729)			e.g. "When I'm in class, I participate in class discussions"
Behavioural disengagement		2.582 (.747)			e.g. "When I'm in class, I just act like I'm working"
Emotional engagement		3.320 (.704)			e.g. "When we work on something in class, I feel interested"
Emotional disengagement		2.422 (.635)			e.g. "When I can't answer a question, I feel frustrated"
Well-being at school	1,396	3.209 (.720)			e.g. "I'm glad I attend this school"
Academic self-concept	1,392	3.784 (.662)			e.g. "I'm good at most school subjects"

Note. Outcomes in grade twelve. Workplace-based learning defined as the median number of weeks (38 hours/week) reported within one's programme (i.e. defined as a school-subfield combination). Full overview of items of non-cognitive outcomes provided in Appendix A1.

Table 2. Impact of work-based learning on cognitive outcomes: linear regression coefficients and standard errors

		Technical track				Vocational track			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**
Numeracy	Work-based learning	-.071**	-.152***	-.101***	-.098***	.014	-.040	-.112***	-.094**
		(.033)	(.042)	(.023)	(.023)	(.026)	(.056)	(.039)	(.047)
N		1,105				399			
Reading comprehension	Work-based learning	-.026	-.093**	-.073**	-.064**	.058***	-.006	.048	.053
		(.035)	(.043)	(.029)	(.027)	(.022)	(.142)	(.166)	(.145)
N		1,032				349			
School-field-of-study fixed effects		.	yes	yes	yes	.	yes	yes	yes
Score in grade eleven		.	.	yes	yes	.	.	yes	yes
Background characteristics		.	.	.	yes	.	.	.	yes

Note. Workplace-based learning equals the median number of weeks reported within one's programme (i.e. defined as a school-subfield combination). Standard errors, displayed between parentheses, are corrected for clustering at the school and the field of study level. *** (**) ((*)) indicates significance at the 1% (5%) ((10%)) significance level. Background characteristics are dummies for gender of the student, language spoken at home (Dutch) by both parents, parents' country of birth (Belgium), parents divorced, parent's highest degree obtained, occupation of parent, and number of books at home. As an exception, the analysis for reading test score control for the test score in grade ten instead of grade eleven.

Table 3. Impact of work-based learning on non-cognitive outcomes: linear regression coefficients and standard errors

		Technical track				Vocational track			
		0	**1**	**2**	**3**	**0**	**1**	**2**	**3**
Motivation									
Autonomous motivation	Work-based learning	-.020 (.030)	-.070* (.041)	-.076** (.029)	-.071** (.029)	.057** (.022)	-.094** (.036)	.006 (.066)	.037 (.056)
Controlled motivation	Work-based learning	-.024 (.025)	-.058 (.036)	-.024 (.023)	-.018 (.025)	.015 (.027)	-.095*** (.026)	-.137*** (.039)	-.126** (.055)
Amotivation	Work-based learning	.032* (.019)	.005 (.018)	-.005 (.019)	-.007 (.020)	-.035 (.022)	-.205** (.093)	-.213*** (.065)	-.206*** (.038)
N		1,015				349			
Engagement									
Behavioural engagement	Work-based learning	-.020 (.022)	-.037 (.028)	-.034** (.016)	-.041*** (.015)	.054*** (.020)	-.072 (.125)	-.015 (.076)	-.034 (.094)
Behavioural disengagement	Work-based learning	.023 (.023)	.047* (.027)	.035* (.020)	.046** (.020)	-.043** (.022)	.124 (.139)	.130*** (.020)	.140*** (.030)
Emotional engagement	Work-based learning	-.045* (.026)	-.098*** (.029)	-.091*** (.025)	-.092*** (.024)	.026 (.023)	-.132*** (.028)	-.070 (.072)	-.036 (.075)
Emotional disengagement	Work-based learning	.048*** (.018)	.096*** (.022)	.069*** (.019)	.074*** (.021)	.001 (.020)	-.037 (.066)	-.009 (.074)	-.043 (.090)
N		1,027				352			
Well-being at school	Work-based learning	-.034 (.025)	-.092*** (.027)	-.069*** (.020)	-.060*** (.021)	.014 (.023)	-.052 (.094)	-.025 (.103)	-.029 (.099)
N		1,037				359			
Academic self-concept	Work-based learning	-.031 (.021)	-.030 (.028)	-.025 (.024)	-.031 (.024)	.034 (.022)	-.123 (.091)	-.043 (.058)	-.016 (.054)
N		1,033				359			
School-field-of-study fixed effects		.	yes	yes	yes	.	yes	yes	yes
Score in grade eleven		.	.	yes	yes	.	.	yes	yes
Background characteristics		.	.	.	yes	.	.	.	yes

Note. Workplace-based learning equals the median number of weeks reported within one's programme (i.e. defined as a school-subfield combination). Standard errors, displayed between parentheses, are corrected for clustering at the school and the field of study level. *** (**) ((*)) indicates significance at the 1% (5%) ((10%)) significance level. Background characteristics are dummies for gender of the student, language spoken at home (Dutch) by both parents, parents' country of birth (Belgium), parents divorced, parent's highest degree obtained, occupation of parent, and number of books at home.

Table 4. Sensitivity and robustness analyses for remaining student heterogeneity

		Technical track			Vocational track	
		A	B	C	A	B
Cognitive educational outcomes						
Numeracy	Work-based learning	-.104***	-.090***	-.131***	-.057	-.209***
		(.034)	(.018)	(.034)	(.050)	(.064)
N		879	728	689	283	153
Reading comprehension	Work-based learning	-.043*	-.069***	-.080**	.051	.034
		(.023)	(.024)	(.031)	(.144)	(.155)
N		879	696	649	283	224
Non-cognitive educational outcomes						
Motivation						
Autonomous motivation	Work-based learning	-.087**	-.059*	-.036	-.021	.054
		(.040)	(.030)	(.044)	(.096)	(.087)
Controlled motivation	Work-based learning	-.033	-.018	-.018	-.122*	-.103
		(.030)	(.025)	(.027)	(.066)	(.084)
Amotivation	Work-based learning	.021	-.045	-.055*	-.241***	-.255***
		(.029)	(.031)	(.030)	(.054)	(.054)
N		879	678	640	283	241
Engagement						
Behavioural engagement	Work-based learning	-.050*	-.036*	-.007	-.067	-.006
		(.026)	(.021)	(.036)	(.044)	(.142)
Behavioural disengagement	Work-based learning	.061**	.033	.011	.048	.088*
		(.029)	(.022)	(.026)	(.076)	(.045)
Emotional engagement	Work-based learning	-.088***	-.099***	-.092***	.015	.009
		(.023)	(.031)	(.033)	(.094)	(.076)
Emotional disengagement	Work-based learning	.079***	.068***	.070***	-.005	-.112
		(.022)	(.024)	(.026)	(.094)	(.128)
N		879	682	642	283	
Well-being at school	Work-based learning	-.052*	-.038	-.052**	-.049	-.037
		(.029)	(.028)	(.025)	(.105)	(.101)
N		879	690	649	283	247
Academic self-concept	Work-based learning	-.017	.005	-.045**	.004	.032
		(.022)	(.021)	(.021)	(.063)	(.069)
N		879	687	645	283	246

Note. Workplace-based learning equals the median number of weeks reported within one's programme (i.e. defined as a school-subfield combination). All models include controls for school-field-of-study fixed effects, analysed (non-)cognitive outcome in grade eleven, and background characteristics. Background characteristics are dummies for gender of the student, language spoken at home (Dutch) by both parents, parents' country of birth (Belgium), parents divorced, parent's highest degree obtained, occupation of parent, and number of books at home. As an exception, the analysis for reading test score control for the test score in grade ten instead of grade eleven. In Model A, we add controls for all cognitive and non-cognitive outcomes in grade eleven. In Model B, we add the analysed (non-)cognitive outcome at the start of grade seven as additional control variable. In Model C, we employ Coarsened Exact Matching (CEM) estimators that match students with over 2.430 median number of weeks of workplace-based learning reported within one's programme with students with less or no work-based learning experience in their programme based on their background characteristics. Standard errors, displayed between parentheses, are corrected for clustering at the school and the field of study level. *** (**) ((*)) indicates significance at the 1% (5%) ((10%)) significance level.

Table 5. Sensitivity and robustness analyses for non-linear relationship between the workplace-based learning and educational outcomes

		Technical track	Vocational track
Cognitive educational outcomes			
Numeracy	Work-based learning	-.210*** (.050)	.324*** (.114)
	(Work-based learning)²	.018*** (.005)	-.041*** (.012)
N		1,105	399
Reading comprehension	Work-based learning	-.090 (.063)	1.488*** (.357)
	(Work-based learning)²	.005 (.008)	-.141*** (.039)
N		1,032	349
Non-cognitive educational outcomes			
Motivation			
Autonomous motivation	Work-based learning	-.167*** (.060)	-.093 (.189)
	(Work-based learning)²	.015* (.008)	.013 (.019)
N		1,015	349
Engagement			
Behavioural engagement	Work-based learning	-.028 (.036)	.390** (.183)
	(Work-based learning)²	-.002 (.004)	-.042** (.018)
Behavioural disengagement	Work-based learning	.115*** (.032)	-.124 (.125)
	(Work-based learning)²	-.011** (.005)	.026** (.013)
Emotional engagement	Work-based learning	-.151*** (.043)	-.503*** (.161)
	(Work-based learning)²	.009** (.005)	.046*** (.018)
N		1,027	352

Note. Workplace-based learning equals the median number of weeks reported within one's programme (i.e. defined as a school-subfield combination). Standard errors, displayed between parentheses, are corrected for clustering at the school and the field of study level. *** (**) ((*)) indicates significance at the 1% (5%) ((10%)) significance level. All models include controls for school-field-of-study fixed effects, analysed (non-)cognitive outcome in grade eleven, and background characteristics. Background characteristics are dummies for gender of the student, language spoken at home (Dutch) by both parents, parents' country of birth (Belgium), parents divorced, parent's highest degree obtained, occupation of parent, and number of books at home. As an exception, the analysis for reading test score control for the test score in grade ten instead of grade eleven. Full set of results provided in Appendix A7.

Table 6. Sensitivity and robustness analyses: impact of an alternative indicator of work-based learning on educational outcomes

		Technical track			Vocational track		
		A	B	C	A	B	C
Cognitive educational outcomes							
Numeracy	Work-based learning	-.088***		-.073***	-.073		.010
		(.023)		(.017)	(.059)		(.015)
N		1,105		1,104	399		385
Reading comprehension	Work-based learning			-.035			-.005
				(.022)			(.022)
N				1,031			336
Non-cognitive educational outcomes							
Motivation							
Autonomous motivation	Work-based learning		-.113***	-.021		.019	.047**
			(.038)	(.027)		(.065)	(.023)
Controlled motivation	Work-based learning		-.005	.004		-.153***	.021
			(.035)	(.019)		(.047)	(.029)
Amotivation	Work-based learning		.018	-.032*		-.221***	-.012
			(.022)	(.017)		(.045)	(.012)
N			688	1,014		240	335
Engagement							
Behavioural engagement	Work-based learning		-.037	-.010		-.049	.047**
			(.023)	(.017)		(.101)	(.022)
Behavioural disengagement	Work-based learning		.078***	.030		.143***	-.035**
			(.017)	(.019)		(.043)	(.017)
Emotional engagement	Work-based learning		-.106***	-.060***		-.042	.048*
			(.039)	(.017)		(.077)	(.025)
Emotional disengagement	Work-based learning		.063**	.048**		-.118*	-.015
			(.025)	(.020)		(.068)	(.023)
N			695	1,026		241	338
Well-being at school	Work-based learning		-.071***	-.041**		-.021	.020
			(.026)	(.018)		(.090)	(.017)
N			702	1,036		246	345
Academic self-concept	Work-based learning		-.027	-.009		-.018	.015
			(.037)	(.022)		(.053)	(.020)
N			695	1,032		245	345

Note. Work-based learning is defined in accordance to the model (Model A to C). In Model A, we re-estimate our models for numeracy relying on the median number of weeks within one's programme up to the date of the numeracy test. In Model B, we re-analyse our data for these non-cognitive outcomes based on a subsample that excludes those students that filled out the survey before the Easter break. In Model C, we re-estimate all models relying on the reported number of weeks of work-based learning at the student level, excluding those students with a work-based learning experience exceeding 13.03 weeks. (The limit of 13.03 weeks is determined using the Interquartile Range (IQR) Method, where outliers are defined as observations that fall a 1.5 factor of the IQR above the 75th percentile of the data). Standard errors, displayed between parentheses, are corrected for clustering at the school and the field of study level. *** (**) ((*)) indicates significance at the 1% (5%) ((10%)) significance level. All models include controls for school-field-of-study fixed effects, analysed (non-)cognitive outcome in grade eleven, and background characteristics. Background characteristics are dummies for gender of the student, language spoken at home (Dutch) by both parents, parents' country of birth (Belgium), parents divorced, parent's highest degree obtained, occupation of parent, and number of books at home. As an exception, the analysis for reading test score control for the test score in grade ten instead of grade eleven.

Appendix

A1. Scales of non-cognitive educational outcomes

Outcome	Items
Motivation	
Autonomous motivation (Cronbach's alpha=.827)	I try my best at school because… (1) it's important to me (2) I want to learn new things (3) I find it interesting (4) it's fun
Controlled motivation (Cronbach's alpha=.844)	I try my best at school because…(1) others expect me to (2) I want the other students to think I'm smart (3) I feel bad, guilty or ashamed of myself when I don't try (4) that's what I'm supposed to do (5) I will feel guilty otherwise (6) I will get in trouble if I don't (7) my teachers will think I'm a good student (8) I otherwise get critiqued
Amotivation	Why do you try your best at school? (1) I don't know why, I don't see what difference it makes
Engagement	
Behavioural engagement (Cronbach's alpha=.815)	(1) When I'm in class, I participate in class discussions (2) When I'm in class, I listen very carefully (3) In class, I work as hard as I can (4) I pay attention in class (5) I try hard to do well in school
Behavioural disengagement (Cronbach's alpha=.802)	(1) In class, I do just enough to get by (2) When I'm in class, I just act like I'm working (3) When I'm in class, my mind wanders (4) I don't try very hard at school (5) When I'm in class, I think about other things
Emotional engagement (Cronbach's alpha=.759)	(1) When we work on something in class, I feel interested (2) Class is fun (3) When I'm in class, I feel good (4) I enjoy learning new things in class
Emotional disengagement (Cronbach's alpha=.658)	(1) When we start something new in class, I feel nervous (2) When I can't answer a question, I feel frustrated (3) When I'm doing work in class, I feel bored (4) When I'm in class, I feel bad (5) When I get stuck on a problem, I feel worried (6) When I get stuck on a problem, it really bothers me
Well-being at school (Cronbach's alpha=.865)	(1) I usually enjoy working for school (2) I find most subjects at school annoying (-) (3) If I could choose, I'd rather go to another school (-) (4) I don't feel like going to school (-) (5) I'm glad I attend this school (6) Instruction at this school is bad (-) (7) I enjoy school (8) If we moved to a different neighbourhood, I'd prefer to keep attending this school (9) I think we do enough fun things at this school
Academic self-concept (Cronbach's alpha=.815)	(1) I learn things quickly in most school subjects (2) I'm good at most school subjects (3) I do well in tests in most school subjects (4) I get bad marks in most school subjects (-)

Note. All non-cognitive educational outcomes are rated on a five-point Likert scale of untrue-true. The negatively formulated items are indicated with the symbol (-) and were inverted so that a high item score corresponds to a positive answer.

A2. Comparison of (non-)cognitive outcomes for our sample of students with valid observations for work-based learning and a sample of students without

(Non-)cognitive outcomes	Sample of technical and vocational students with valid information for work-based learning Mean (Std.Dev.)	N	Sample of technical and vocational students with missing, inconsistent or erroneous data for work-based learning Mean (Std.Dev.)	N
Numeracy	103.14 (15.26)	2,412	99.12 (16.64)	622
Reading comprehension	83.68 (13.51)	2,228	79.50 (14.57)	865
Autonomous motivation	3.40 (.82)	2,174	3.41 (.84)	876
Controlled motivation	2.88 (.84)	2,174	2.89 (.82)	876
Amotivation	2.19 (1.17)	2,226	2.29 (1.17)	883
Behavioural engagement	3.46 (.73)	2,182	3.39 (.75)	877
Behavioural disengagement	2.62 (.74)	2,182	2.68 (.74)	876
Emotional engagement	3.31 (.72)	2,184	3.31 (.74)	877
Emotional disengagement	2.45 (.64)	2,184	2.49 (.64)	877
Well-being at school	3.18 (.74)	2,207	3.14 (.72)	893
Academic self-concept	3.76 (.67)	2,196	3.73 (.68)	883

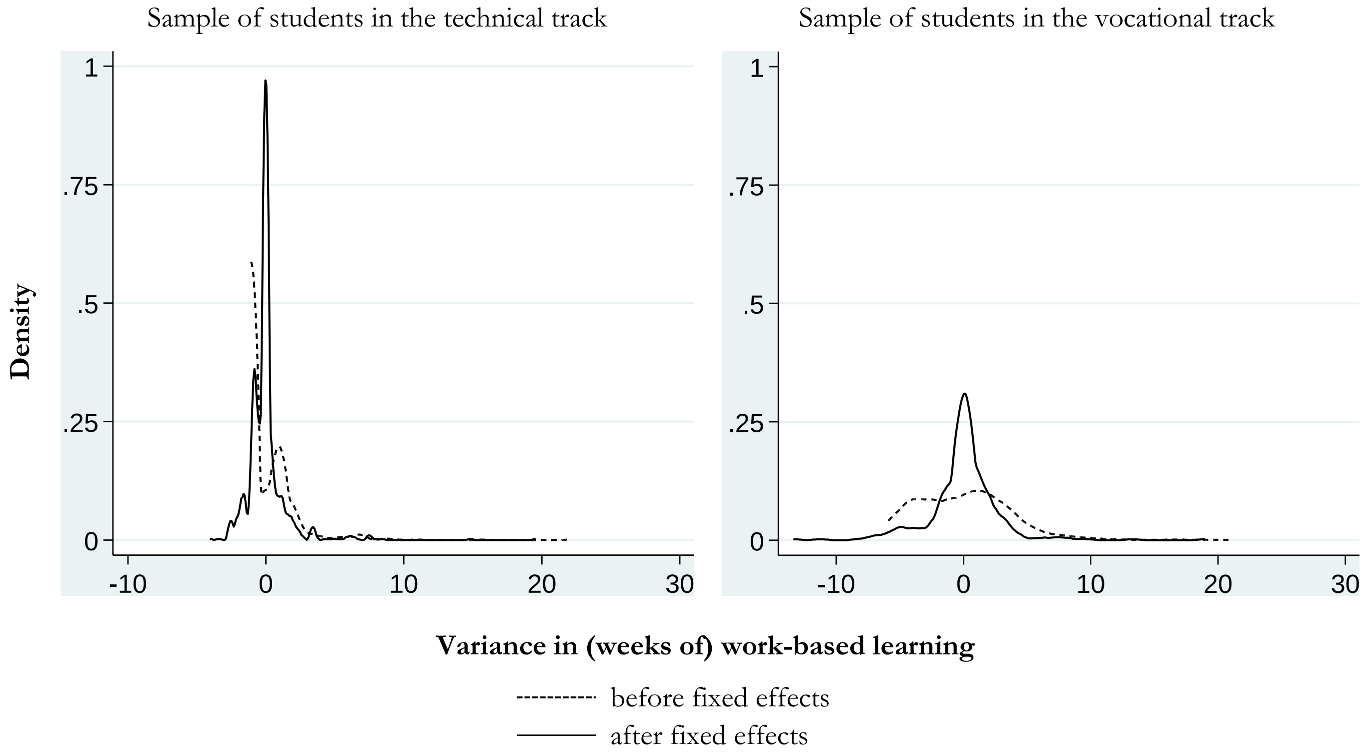
Note. Mean and standard deviation for full sample of technical or vocational students dependent on work-based learning experience, regardless of background characteristics and outcome in the previous grade (grade eleven).

A3. Descriptive statistics: background characteristics

Characteristic	Mean (std.dev.)	Explanation
Gender student	.569 (.495)	Dummy male student; female student (=0)
Home language Dutch	.846 (.361)	Dummy parents converse in Dutch with the student; another language than Dutch (=0)
Country of birth Belgium	.827 (.379)	Dummy parents born in Belgium; born abroad (=0)
Parents divorced	.264 (.441)	Dummy parents divorced or one parent deceased; parents together (=0)
Parent(s) highest degree obtained	.169 (.375)	Dummy lower secondary education or lower (ref.)
	.298 (.457)	Dummy higher secondary education
	.375 (.484)	Dummy lower tertiary education
	.123 (.328)	Dummy higher tertiary education (university)
	.035 (.185)	Dummy foreign degree
Occupation of parent(s)	.073 (.260)	Dummy unskilled blue-collar worker; e.g. working at an assembly line (ref.)
	.074 (.262)	Dummy skilled blue-collar worker; e.g. plumber
	.146 (.353)	Dummy lower white-collar worker; e.g. salesperson
	.285 (.451)	Dummy higher white-collar worker; e.g. nurse, engineer
	.080 (.271)	Dummy management position; e.g. CEO
	.082 (.274)	Dummy teaching staff: secondary education or lower
	.007 (.082)	Dummy teaching staff: tertiary education
	.147 (.354)	Dummy wholesaler; e.g. import-export, owner of a large firm
	.021 (.144)	Dummy small business owner; e.g. butcher, fisher, baker
	.039 (.194)	Dummy liberal profession; e.g. doctor, lawyer, architect
	.047 (.212)	Dummy other occupation
Number of books at home	.094 (.292)	Dummy 0-10 books (ref.)
	.184 (.388)	Dummy 11-25 books
	.368 (.482)	Dummy 26-100 books
	.171 (.377)	Dummy 101-200 books
	.183 (.387)	Dummy over 200 books

Note. N=1,615. Information on the student's parent(s) was also collected at the start of secondary education in 2013. Parents who did not fill out the survey in 2013 were invited to fill in the parent survey in the subsequent year(s).

A4. Graphical depiction of variance in (weeks of) work-based learning before and after fixed effects



Note. The two panels display the variance of the treatment, work-based learning, before (dashed line) and after (solid line) fixed effects for groups of students that participate in the same field of study in the same school (i.e. school-field-of-study combination) are applied.

A5. Sensitivity and robustness analyses for alternative fixed effects

		Technical track		Vocational track	
Cognitive educational outcomes					
Numeracy	Work-based learning	-.080***	-.061**	.024	.026
		(.024)	(.028)	(.034)	(.026)
N		1,105		399	
Reading comprehension	Work-based learning	-.046*	-.018	.065	.000
		(.027)	(.039)	(.043)	(.017)
N		1,032		349	
Non-cognitive educational outcomes					
Motivation					
Autonomous motivation	Work-based learning	-.051*	-.042*	.088***	.021
		(.026)	(.022)	(.031)	(.038)
Controlled motivation	Work-based learning	-.008	-.008	.010	.009
		(.021)	(.020)	(.036)	(.018)
Amotivation	Work-based learning	.016	.001	.011	.054**
		(.023)	(.017)	(.039)	(.021)
N		1,015		349	
Engagement					
Behavioural engagement	Work-based learning	-.015	-.016	.027	-.014
		(.016)	(.015)	(.036)	(.017)
Behavioural disengagement	Work-based learning	.026*	.029	.015	.059***
		(.015)	(.017)	(.022)	(.013)
Emotional engagement	Work-based learning	-.062**	-.059**	.048	-.017
		(.027)	(.021)	(.037)	(.020)
Emotional disengagement	Work-based learning	.060***	.049***	-.063*	.014
		(.016)	(.015)	(.032)	(.032)
N		1,027		352	
Well-being at school	Work-based learning	-.038**	-.030*	.047	-.001
		(.018)	(.016)	(.031)	(.019)
N		1,037		359	
Academic self-concept	Work-based learning	-.042*	-.003	.017	-.016
		(.024)	(.025)	(.017)	(.020)
N		1,033		359	
School-level fixed effects		yes	.	yes	.
Field of study-level fixed effects		.	yes	.	yes

Note. Workplace-based learning equals the median number of weeks reported within one's programme (i.e. defined as a school-subfield combination). Standard errors, displayed between parentheses, are corrected for clustering at the school level when controlling for school fixed effects and the field-of-study level when controlling for field-of-study fixed effects. *** (**) ((*)) indicates significance at the 1% (5%) ((10%)) significance level. All models include controls for analysed (non-)cognitive outcome in grade eleven, and background characteristics. Background characteristics are dummies for gender of the student, language spoken at home (Dutch) by both parents, parents' country of birth (Belgium), parents divorced, parent's highest degree obtained, occupation of parent, and number of books at home. As an exception, the analysis for reading test score control for the test score in grade ten instead of grade eleven.

A6. Multiple testing

In this study, we aim to assess the impact of the amount of work-based learning in grade twelve on both students' cognitive and non-cognitive educational outcomes. However, using multiple indicators of the same dataset to test our hypotheses entails a risk, as performing multiple simultaneous statistical tests of the same dataset can lead to an increased risk of rejecting the null hypothesis.

To assess whether multiple testing may explain our outcomes, we conduct a Benjamini-Hochberg procedure (Benjamini & Hochberg, 1995), on each of the two subfamilies of tests, namely cognitive and non-cognitive outcomes. This procedure is a powerful tool that assesses the influence of multiple testing for each effect individually and, thereby, decreases the false discovery rate. The procedure is built on three steps. First, the p-values on the individual tests are ranked in ascending order with the smallest p-value having a rank of 1 and the largest p-value having a rank equal to the total number of tests. Second, we compute for each individual p-value the Benjamini-Hochberg critical value based on the formula $(i/m)Q$, with i being the individual p-value's rank, m being the total number of tests and Q being the false discovery rate. The latter rate, the maximum proportion among all significant results that are false positives, is set at a predetermined level by the researcher. Third, one has to compare the original p-values to the critical Benjamini-Hochberg values and find the largest p-value that is smaller than the critical value. All effects with a rank that is equal or below the rank in step three are gauged to be statistically significant.

In Table A, we report the results of this procedure when setting the False discovery Rate at 10%. These results of this procedure do not affect our conclusions regarding any of the outcome indicators and for none of the two tracks.

Table A. Benjamini-Hochberg test results (False Discovery Rate = 10%) to correct for multiple testing

	Technical track					**Vocational track**				
Tested outcomes	*P*-value	Rank	$(i/m)Q$	Rank	$(i/m)Q$	*P*-value	Rank	$(i/m)Q$	Rank	$(i/m)Q$
Numeracy	.000	1	**.050**			.049	1	**.050**		
Reading comprehension	.019	2	**.100**			.718	2	.100		
Autonomous motivation	.017			5	**.056**	.515			4	.044
Controlled motivation	.470			8	.089	.024			3	**.033**
Amotivation	.729			9	.100	.000			1	**.011**
Behavioural engagement	.007			4	**.044**	.720			7	.078
Behavioural disengagement	.027			6	**.067**	.000			2	**.022**
Emotional engagement	.000			1	**.011**	.631			5	.056
Emotional disengagement	.001			2	**.022**	.636			6	.067
Well-being at school	.004			3	**.033**	.771			9	.100
Academic self-concept	.207			7	.078	.765			8	.089

Notes: *P*-values derived from Table 2 (model (3)) for the cognitive outcomes and Table 3 (model (3)) for non-cognitive outcomes. Values in bold are for effects assessed to be significant based on the Benjamini-Hochberg procedure.

A7. Sensitivity and robustness analyses for non-linear relationship between the workplace-based learning and educational outcomes

		Technical track (A)	Technical track (B)	Technical track (C)	Vocational track (A)	Vocational track (B)
Cognitive educational outcomes						
Numeracy	Work-based learning	-.210*** (.050)	-.300*** (.065)	-.406*** (.086)	.324*** (.114)	-.411 (.255)
	(Work-based learning)²	.018*** (.005)			-.041*** (.012)	
N		1,105			399	
Reading comprehension	Work-based learning	-.090 (.063)	-.166** (.075)	-.206** (.094)	1.488*** (.357)	.614 (.629)
	(Work-based learning)²	.005 (.008)			-.141*** (.039)	
N		1,032			349	
Non-cognitive educational outcomes						
Motivation						
Autonomous motivation	Work-based learning	-.167*** (.060)	-.230*** (.077)	-.299** (.119)	-.093 (.189)	.151 (.316)
	(Work-based learning)²	.015* (.008)			.013 (.019)	
Controlled motivation	Work-based learning	-.007 (.048)	-.035 (.071)	-.021 (.097)	-.189 (.228)	-.675** (.313)
	(Work-based learning)²	-.002 (.005)			.006 (.024)	
Amotivation	Work-based learning	.043 (.046)	.015 (.063)	.078 (.086)	-.055 (.181)	-1.077*** (.229)
	(Work-based learning)²	-.008 (.005)			-.015 (.019)	
N		1,015			349	
Engagement						
Behavioural engagement	Work-based learning	-.028 (.036)	-.101** (.048)	-.119* (.068)	.390** (.183)	-.066 (.520)
	(Work-based learning)²	-.002 (.004)			-.042** (.018)	
Behavioural disengagement	Work-based learning	.115*** (.032)	.156*** (.049)	.215*** (.060)	-.124 (.125)	.697*** (.171)
	(Work-based learning)²	-.011** (.005)			.026** (.013)	
Emotional engagement	Work-based learning	-.151*** (.043)	-.261*** (.061)	-.317*** (.084)	-.503*** (.161)	-.309 (.368)
	(Work-based learning)²	.009** (.005)			.046*** (.018)	
Emotional disengagement	Work-based learning	.129** (.055)	.216*** (.072)	.274*** (.097)	-.447 (.421)	-.293 (.421)
	(Work-based learning)²	-.009 (.005)			.040 (.043)	
N		1,027			352	
Well-being at school	Work-based learning	-.114** (.053)	-.181*** (.069)	-.234** (.098)	.514 (.457)	-.066 (.416)
	(Work-based learning)²	.008 (.005)			-.054 (.046)	
N		1,037			359	
Academic self-concept	Work-based learning	-.011 (.041)	-.073 (.068)	-.089 (.079)	.358 (.348)	-.029 (.216)
	(Work-based learning)²	-.003 (.003)			-.037 (.036)	
N		1,033			359	

Note. Work-based learning is defined in accordance to the model (Model (A) to(C)). In Model (A), we adopt the median number of weeks of workplace-based learning reported within one's programme (i.e. defined as a school-subfield combination) and add its' quadratic term to our model. In Model (B), the median number of weeks of work-based learning reported within one's programme is log-transformed. In Model (C), we adopt a dummy variable (0/1) for work-based learning reported within one's programme. Standard errors, displayed between parentheses, are corrected for clustering at the school and the field of study level. *** (**) ((*)) indicates significance at the 1% (5%) ((10%)) significance level. All models include controls for school-field-of-study fixed effects, analysed (non-)cognitive outcome in grade eleven, and background characteristics. Background characteristics are dummies for gender of the student, language spoken at home (Dutch) by both parents, parents' country of birth (Belgium), parents divorced, parent's highest degree obtained, occupation of parent, and number of books at home. As an exception, the analysis for reading test score control for the test score in grade ten instead of grade eleven.