Does self-efficacy contribute to the development of students' motivation across the transition from secondary to higher education?

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Eva Kyndt, Vincent Donche, Liesje Coertjens, Tine van Daal, David Gijbels, & Peter Van Petegem

Abstract

The transition from secondary to higher education is a challenging process, in which the development of students' motivation plays a pivotal role. The current study examines whether self-efficacy – and how it develops – is able to explain the growth in motivation. The current longitudinal study included five waves, across a period of 25 months (i.e. start of the final year of secondary education until the beginning of the second year of higher education). Results show – contrary to our hypothesis based on the self-determination theory and social cognitive theory – that the growth in autonomous motivation positively predicts the growth in self-efficacy and that this 'reversed' model is superior in terms of fit and explained variance to the hypothesized model.

Keywords: Motivation; Self-efficacy; Transition; Longitudinal Growth Analysis; Higher Education

Introduction

It has been well established that students face several challenges when they move on from secondary to higher education. For example, when moving on to higher education, almost half the students do not succeed in their first year, and often withdraw from education altogether (OECD, 2010). These challenges can be linked to the important choices students have to make in terms of the discipline or even professional career they want to pursue, but also to the fact that higher education differs considerably from secondary education (e.g., teaching methods, level of autonomy, quantity of materials, etc.; Authors, year).

As the transition from secondary to higher education is a challenging process for many students (Briggs, Clark, & Hall, 2012; Christie, Tett, Cree, Hounsell, & McCune, 2008), students' academic motivation and how it develops across the transition from secondary to higher education seems pivotal. Prior research has shown that students' academic motivation relates to persistence (Vansteenkiste et al., 2010), and a lack of motivation was found to be the main indicator of students dropping out in their first year of higher education (Vanthournout, Gijbels, Coertjens, Donche, Van Petegem, 2012). In addition, motivation can vary over time and different contexts (e.g., authors, year; Pan & Gauvain, 2012; Ratelle, Guay, Larose, & Senécal, 2004), and can be an important tool to increase academic achievement in higher education (e.g., Winn, 2002 Cerasoli, Nicklin, & Ford, 2014).

While longitudinal studies on the development of academic motivation are relatively limited, especially with regards to the transition between different educational levels (e.g., Eccles, Lord, & Buchanan, 1996; Pan & Gauvain, 2012), even fewer studies have tried to explain this development. In the literature, the relationship between self-efficacy and academic motivation has received a lot of attention (Pintrich & Schunk, 1995). However, difficulties have been identified in terms of clarifying the nature of the relationship between

self-efficacy and academic motivation (Pajares, 1996). Starting from the self-determination theory (Deci & Ryan, 2002), the current study examined, using a longitudinal design, if the development of self-efficacy contributes to the development of students' academic motivation as they progress from secondary to higher education. By investigating the relationship between self-efficacy and academic motivation over time, we aim to expand upon present insights into the causal ordering of these constructs. The current manuscript starts with illustrating the importance of self-efficacy in the transition from secondary to higher education and the relationship between self-efficacy and academic motivation as described by prior research. Subsequently, the methodology and results of the longitudinal analyses are discussed. Finally, the conclusions, limitations and future research perspectives are considered.

Theoretical Background

Self-efficacy and the Transition from Secondary to Higher Education

Self-efficacy is a core concept within the social cognitive theory put forward by Bandura (1986). An individual's self-efficacy refers to the belief an individual has in one's own capabilities to "organize and execute the courses of action required to manage prospective situations" (Bandura, 1997, p. 3). Self-efficacy is a multifaceted construct (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996) and when assessing self-efficacy, it is important that an optimal level of specificity is applied in order to increase the accuracy of prediction. This level of specificity or focus on specific types of performance and results distinguishes self-efficacy from other general measures of perceived capability (Pajares, 1996). Different levels of specificity can be chosen ranging from general self-efficacy across different domains in life, self-efficacy pertaining to academic performances and learning behaviour or self-efficacy focusing on specific study subject. As this study considers students from various

disciplines, we will focus on academic self-efficacy that is concerned with the belief students have in their capabilities to successfully complete education. This choice is in line with Bandura's (2012) argument that people differ in their efficacy across different activity domains, and that measures should suit the activity domain on which the study focuses (i.e. academic learning in this study).

Self-efficacy mediates the relationship between knowledge and action, and influences this behaviour in a variety of ways. Prior research has shown that self-efficacy has a positive influence on the effort individuals invest in specific activities, their perseverance, especially when facing obstacles and difficulties, and the resilience they show when confronted with problems and disappointments (Bandura, 1993; Pajares, 1996). In addition, self-efficacy reduces stress in taxing situations. Finally, self-efficacy also influences the choices individuals make; for example, individuals with lower levels of self-efficacy tend to avoid challenging situations and activities because they fear that they will not be able to cope (Bandura, 1993).

During the transition from secondary to higher education, students have to choose a level of study (e.g. college or university), a study discipline and institution. Prior research has shown that self-efficacy affects the course of life paths, as it plays a role in career choice and development (Bandura, 1993). The choices that students make when moving on to higher education can be considered a starting point for their career; hence it can be expected that self-efficacy will be important during this transition as self-efficacy affects the choices students' make (Brooman & Darwent, 2014). In addition, research by Christie et al. (2008) showed that entering university and adapting to higher education is an emotionally demanding situation for students in which they experience both excitement and stress. In secondary education, students were familiar with their environment, their teachers, their fellow students and the volume and level of the work. This is, however, not the case when

entering higher education where different standards and rules apply. High levels of self-efficacy can be expected to enhance the transition process, as it will contribute to students' perseverance and resilience when handling new and potentially stressful situations (Bandura, 1993; Pajares, 1996). In a recent systematic review and meta-analysis of predictors of first-year higher academic performance, self-efficacy was found to be a very important explanatory factor (Richardson, Abraham, & Bond, 2012).

Motivation across the Transition from Secondary to Higher Education

As mentioned, this study aims at clarifying the relationship between self-efficacy and academic motivation across the transition. While different theoretical frameworks exist for conceptualising academic motivation, the current study relies on the framework of Deci and Ryan (2002). This framework is deemed appropriate because this conceptualisation of motivation does not include perceptions of capability similar to the construct of self-efficacy or self-concept theory in which perceptions of self-worth include a judgment of self-confidence against a frame of reference or standard (Bong & Skaalvik, 2003; Pajares, 1996). For a more elaborate discussion about the similarities and differences between self-efficacy and self-concept the reader is referred to the article of Bong and Skaalvik (2003).

The self-determination theory (SDT) conceives motivation as a multidimensional concept, including both the quality and quantity of motivation (Deci & Ryan, 2002). Different types of motivation are placed on a continuum, from more to less self-determined, depending on the degree to which the motivation is internalised (Vansteenkiste, Lens, & Deci, 2006). Individuals can experience the regulation of their own behaviour as coming from themselves (internal regulation) or coming from external factors (external regulation), such as other people, circumstances and possible consequences (Deci & Ryan, 2002; Vansteenkiste et al., 2006).

Intrinsic motivation can be found at the top end of the continuum, with the highest amount of internal regulation. When considering motivation for learning, intrinsically motivated students learn out of a sincere interest in learning and for the joy of learning itself, regardless of the outcomes or consequences. Subsequently, *identification* is placed on the continuum. Students, who identify with the value of learning, see the personal relevance of learning and engage in learning voluntarily. They experience regulation as coming from themselves, due to the perceived value they attach to it. Intrinsic motivation and identification together constitute students' *autonomous motivation*.

The first type of a more externally regulated motivation is *introjected regulation*. Introjectedly regulated students learn to avoid shame or guilt and pursue self-worth (Vansteenkiste et al., 2006). In other words, their reasons for learning are not completely due to external factors, but have not been fully internalised either. The second type of externally regulated motivation is situated at the opposite end of the continuum from intrinsic motivation. With *external regulation,* the reason for learning has not been internalised at all. Students learn to avoid punishments or to receive rewards. Introjected and external regulation combined constitutes *controlled motivation* (Deci & Ryan, 2002). Besides these qualitative differences in motivation, SDT also considers the quantity of motivation. When students lack motivation to study and do not see any reason for it, motivation is considered to be absent. Therefore, the final type of motivation that will be considered is *amotivation* (Deci & Ryan, 2002).

While the majority of longitudinal studies examining the development of academic motivation over time concentrate on primary and secondary education, some studies also focus on the development of motivation *within higher education* (Müller & Palekčić, 2005; Ratelle et al., 2004; Pan & Gauvain, 2012). Ratelle et al. (2004) found that, on average, students' intrinsic motivation increases. Müller and Palekčić (2005) only found an increase in

autonomous motivation between the second and third years of study. Pan and Gauvain (2012) did not identify any significant differences between years two and three. However, both Müller and Palekčić (2005) and Pan and Gauvain (2012) found a decrease in autonomous motivation between the first and second years of higher education. To our knowledge, our study (authors, year) is one of the few that has examined the development of motivation on a longitudinal basis across the transition from secondary to higher education. In general, the results of this study show that autonomous motivation increases, and that controlled motivation and amotivation do not change substantially over time. Amotivation was significantly lower at the start of higher education in comparison with the end of secondary education (authors, year) however the difference was rather small.

The Relationship between Self-efficacy and Motivation

Within educational research focusing on self-efficacy, the relationship between self-efficacy and academic motivation can be considered one of the main research topics (Pintrich & Schunk, 1995). Prior research has shown that self-efficacy is indeed related to various motivational processes including the motivational constructs stipulated above (Alivernini & Lucidi, 2011; Bandura, 1993). Bouffard, Boileau, and Vezeau (2001) state: "the motivational processes that support the use of cognitive and self-regulatory processes are based on students' self-efficacy" (p. 590). However, Pajares (1996) warns that "subsuming beliefs of personal efficacy under different motivation constructs can be problematic in that it can obfuscate important differences between the self-beliefs and minimize the unique contribution that self-efficacy perceptions make to an understanding of motivation and behaviour" (p. 257). Consequently, Pajares (1996) recommended investigating the unique contribution of self-efficacy to academic motivation through longitudinal designs, as these designs have the potential to contribute to the debate about the nature and the causality of the

relationship between self-efficacy and academic motivation. While prior research using SDT, often uses the term motivation for a family of variables energizing activity (e.g., competence, relatedness, self-efficacy, interest, …), the current study focuses on the motivational variables defined by SDT.

For determining the directionality of the relationship between self-efficacy and motivation, we build on two theories: The social cognitive theory and the self-determination theory. The social cognitive theory proposes that people act on their beliefs. Stajkovic and Luthans (2003, p. 131) state that "a sense of high self-efficacy may help sustain motivated efforts, even in the light of adverse conditions and uncertain outcomes". However, this theory foremost emphasise that both self-efficacy and motivation need to be considered when explaining behaviour. As such, this theory does not provide strong evidence for the directionality. The self-determination theory (SDT) and the other hand is clearer about its expectations. While SDT does not use the term self-efficacy, it does focus on an individual's innate basic psychological needs, including the need for competence. According to Sheldon, Elliot, Kim, and Kasser (2001), the need for competence is fulfilled when people feel capable and effective in the actions they undertake. This definition shows great resemblance to how Bandura (1997) conceptualises self-efficacy in his social cognitive theory. It appears that self-efficacy can be considered as a fulfilled need for competence. According to the basic needs approach, incorporated in the self-determination theory, the fulfilment of the psychological need for competence leads to a higher intrinsic motivation or – more generally – positive situational motivation (Deci & Ryan, 2002; Otis, Grouzet, & Pelletier, 2005; Schüler, Sheldon, & Fröhlich, 2010). In addition, similar to the research on self-efficacy, prior studies have shown that effects are stronger when domain-relevant need satisfaction was considered (Schüler et al., 2010). In this vein, students' self-efficacy for learning seems to be interesting within the domain of education, especially when considering the challenging

circumstances of a transition, and has been found to enhance students' academic motivation to learn (Ryan & Deci, 2000).

Present Study

This study aimed to investigate the contribution of self-efficacy to the development of motivation across the transition from secondary to higher education. Theoretical expectations were driving our study. It was expected that high levels of self-efficacy would correspond to a stronger development of students' motivation across the transition to higher education (e.g., Alivernini & Lucidi, 2011, Armor & Taylor, 1998, Bandura, 1993). The current longitudinal study examined the contribution of self-efficacy, while controlling for differences in the socio-economic background of students, because an empirical qualitative study by Winn (2002) indicated that the socio-economic status of students could influence their motivation for learning.

The current study was conducted within the context of Flanders, the Dutch speaking part of Belgium. With the exception of specific disciplines (e.g. medicine and specific art forms), higher education in Flanders is accessible to all students, who have graduated from secondary education, without them having to do an entrance exam or pass a selection procedure. More specifically, graduates from general secondary education, as well as technical education, are automatically allowed access to higher education, with general secondary education being considered a better preparation for higher education. Therefore, we will also control for the type of secondary education students followed. In addition, it is important to bear in mind that higher education is financially supported by the government. This means that tuition fees are relatively low in comparison with educational systems in the US or UK for example, making the sample of students entering higher education in Flanders

more diverse in comparison with samples from countries with high tuition fees and competitive admissions procedures.

Motivation: Measurement Invariance and Development

The current study extends our previous study (authors, year), in which the development of motivation was assessed in-depth by means of multi-indicator latent growth models. The results of this study will be summarised in this paragraph, however for all details on the analyses, we refer the reader to the original study (authors, year). The results of our prior study showed that for the autonomous motivation scale, longitudinal measurement invariance was established. In contrast, only partial invariance was found for controlled motivation and amotivation, as some of the intercept loadings had to be freed in order to achieve an acceptable model fit. As a consequence, manifest scale scores could not be relied upon and a multi-indicator latent growth model was applied, allowing us to model the differences in intercepts across waves.

In general, the results showed that, on average, students' autonomous motivation increased across the five waves, with a strong increase across the transition from secondary to higher education. The change in controlled motivation is limited, but nevertheless shows a small increase during the transition from secondary to higher education. Finally, amotivation increased within secondary education, but was significantly lower at the start of higher education and henceforth remained stable (authors, year).

Method

Design and Participants

Data were collected as part of a large-scale longitudinal project, examining the transition made by students leaving secondary education at five different moments (van Daal,

Coertjens, Delvaux, Donche, & Van Petegem, 2013). During the final year of secondary education, two data collections were organised during school hours, in November and May (a school year starts September 1st and ends June 30th). During the second wave, students were asked to provide their contact information (e-mail, home address and telephone number). They also completed a consent form, which gave permission to do a follow-up after they graduated from secondary school. The challenge in terms of attrition started from wave three onwards because at that moment students had left secondary school and were following different trajectories (e.g. moving onto to higher education, entering the workforce, taking a year off, etc.). The third and fourth measurement waves were organised in the first year following students' graduation from secondary education. More specifically, data was collected in December and May (an academic year in Flanders starts in mid-September and ends at the beginning of July). The fifth and final wave took place in December of the following year.

As this research study focuses on the transition from secondary to higher education, only students who indicated that they had continued onto higher education after graduating from secondary school were included in the analysis. All potential participants were invited to participate in every wave regardless of whether they had participated in the wave before. At T1 607 students participated, at T2 560 students, 342 at T3, 402 at T4 and 452 students participated at T5. In total, 630 different students from 31 schools were included in the analysis as they participated in at least one wave within secondary education and one wave in higher education (necessary to determine whether or not they actually transitioned to higher education). Similar to the enrolment statistics of higher education institutions, the majority of the sample was female and came from a general secondary education background. There were 373 females versus 257 males, and 475 students from general secondary education

versus 155 students from technical secondary education. In addition, 390 students indicated that their mother holds a higher education degree.

Before continuing the analyses, different ANOVA analyses were executed to test whether participants and non-participants in each wave differed, in terms of their motivation and self-efficacy. These analyses were executed in order to explore whether we could consider data to be completely missing at random, which is an assumption when using maximum likelihood estimation (see below). The only difference that was found was that students who did not participate in wave 4 scored slightly lower on autonomous motivation in wave 2 (F = 5.08, df = 549, p = .025, η^2 = .009) and higher on controlled motivation (F = 5.02, df = 339, p = .026, η^2 = .009) in wave 3. The same results were found for students who participated in wave 5 and those who did not (autonomous wave 2: F = 5.11, df = 549, p = 024, η^2 = .009; controlled wave 3: F = 6.57, df = 339, p = .011, η^2 = .019). Given that no consistent patterns were found across the different waves and that for the few differences that were found between two time points the effect sizes were very low, it can be concluded that the effect of attrition on the results of this study is limited. The only difference that was found is that students who participated in wave 2 scored slightly higher on self-efficacy at wave 1 in comparison with students who did not participate in wave 2 (F = 4.62, df = 603, p = .032, η^2 = .008). Again, the effect size can be considered small. For the other waves, no differences were found. Overall it can be concluded that students who participated in the different waves and those who did not were largely comparable.

Instruments

Motivation. A short translated version of the Self-Regulation Questionnaire (SRQ; Ryan & Connell, 1989) was used to measure students' motivation for learning. This questionnaire was developed based on the Dutch adaptation of the SRQ (Vansteenkiste,

Sierens, Soenens, Luyckx, & Lens, 2009) and the Academic Motivation Scale (AMS), by Vallerand and colleagues (1992), and comprises three scales: autonomous motivation (six items: e.g., 'I study because I enjoy studying'), controlled motivation (six items: e.g., 'I study because I would feel bad about myself if I did not) and amotivation (three items: e.g., 'Honestly I do not know, it feels like I am wasting my time at school / within higher education'). All items were scored on a 5-point Likert scale.

Self-efficacy. Self-efficacy for learning was measured using four items (e.g. 'I am satisfied with my study skills'), based on research on self-efficacy (Pintrich et al, 1993) and perceived competence (Ryan & Deci, 2000), measuring students' confidence in their own learning abilities. A sample item is "I belief I can study well". (Authors, year). All items were scored on a 5-point Likert scale[1].

Background / control variables. Several indicators describing the socio-economic backgrounds of students were included. More specifically, students were asked to indicate whether they received a study allowance from the Flemish Government (i.e. depending on family income), if they spoke Dutch at home (i.e. same language used in schools) and in which type of neighbourhood they lived (i.e. high concentration of minority groups). Furthermore, information regarding the highest educational degree obtained by the mother was collected. This categorical variable was transformed into a dummy variable, indicating whether the mother successfully completed higher education or not. This indicator was selected because prior research has shown that students with parents that did not attend higher education typically face a more challenging transition to higher education (e.g., Ishitani, 2003). A final measure that was included pertained to the type of education (general or technical) students followed in secondary education.

[1] Due to technical issues at T3, participants were (only at wave 3) presented with 5 options for answering, but 7 boxes that could be ticked. In order to keep calculate growth patterns comparable to the first study on the development of motivation, answers were recoded to the indicated 5-point scale (e.g. neutral answer = neutral score, ends of the continuum were coded 1 and 5, etc.)

Analysis

The analysis began by checking the structure and reliability of the instruments. Confirmatory factor analyses were conducted and the internal consistency of the scales at each wave were calculated. In addition, the longitudinal measurement invariance of the scales was examined. Such analysis consists of testing whether factor loadings and intercepts are equal over time (Coertjens, Donche, De Maeyer, Vanthornout, & Van Petegem, 2012) and is assessed for each scale separately.

Parallel latent growth curve analysis was used to examine the contribution of students' self-efficacy to the development of students' motivation (Muthén & Muthén, 2010). This analysis allows the simultaneous modelling of growth trajectories of different variables, and provides the opportunity to examine the relationships between these growth trajectories. Maximum likelihood estimation makes it possible to perform analysis on the entire sample (retaining students who did not participate in every wave), as methodological research has shown the benefits of including respondents with incomplete data, that is missing data at one or two time points (Enders & Bandalos, 2001). As the data were gathered at unequal time intervals (6 months, 7 months, 5 months and 7 months respectively), the factor loading values for the slope were fixed to 0, 0.5, 1.08, 1.5 and 2.08 respectively (Coertjens, Donche, De Maeyer, Vanthournout, & Van Petegem, 2013). Finally, analyses were run on the individual level using the "type = complex" option to account for the nested structure of the data (i.e. students nested in secondary schools) when calculating standard errors and fit indices.

The exploratory analyses were conducted using R software (R Development Core Team, 2012); the packages *lavaan* (Rosseel, 2012), *qgraph* (Epskamp, Cramer, Waldorp, Schmittmann, & Borsboom, 2012), *Hmisc* (Harrell, 2012) and *psych* (Revelle, 2012) were

used. Longitudinal measurement invariance and parallel growth curve analysis was performed with Mplus version 6.1.

Results

Measurement Invariance Self-efficacy

When conducting longitudinal research and examining growth over time, it is important to establish longitudinal measurement invariance. Measurement invariance allows researchers to accept that individual questions and their respective constructs are interpreted in similar ways across different waves. It is required for assessing growth over time when using mean scale scores instead of latent constructs (Coertjens et al., 2012; Van de Schoot, Lugtig, & Hox, 2012).

The analysis began by assessing the internal consistency of the self-efficacy scale at each wave. Results were satisfactory and showed that Cronbach's alphas ranged from 0.85 to 0.92. In addition, a confirmatory factor analysis at each wave confirmed the four-scale structure (three motivational scales and self-efficacy) of our instrument (See Table 1). Subsequently, tests were done to see whether the basic model structure is invariant across waves (configural invariance). Results showed that the participants conceptualise the construct of self-efficacy similarly at each wave (see Table 2). To verify whether the separate items are interpreted in the same way over time, the factor loadings were adjusted so that they were equal across waves. When the model fit does not decrease too much in comparison with the configural model, it can be concluded that items are interpreted in a similar way over time (metric invariance). The difference in model fit between the configural and metric models is acceptable if the difference between the CFI of the configural model and the CFI of the model with fixed factor loadings is smaller than 0.01. Ideally, the difference in the chi-square test should also not be significant. However, the chi-square statistic is sensitive to sample

size, even if the sample size is quite small (Iacobucci, 2010). Table 2 shows that metric invariance was achieved for the scale measuring self-efficacy.

In a final step, the indicator intercepts were also fixed to be equal across waves, in order to test for scalar invariance (Van de Schoot et al., 2012). Scalar invariance indicates that the difficulty level of the indicators is comparable over time. The results show that scalar invariance was confirmed for the self-efficacy scale (Table 2). Descriptive statistics and internal consistencies of the scales at each wave can be found in Table 3. In line with the guidelines of Fornell and Lacker (1981), Table 4 shows that discriminant validity of the scales was confirmed at wave 1. The average variance extracted of each scale exceeds the variance the scale shares with other constructs. As measurement invariance across time was demonstrated, there is no need to test this for every wave separately.

The Contribution of Self-Efficacy

The main aim of the current article is to examine whether self-efficacy and how it develops is able to explain the growth patterns in motivation, which were identified in our prior study (authors, year). Therefore, the analysis began with the model specifications of the identified growth trajectories of motivation; that is growth trajectories with free time scores for autonomous and controlled motivation and a piecewise discontinuous growth model for amotivation. For both, autonomous motivation and self-efficacy scalar measurement invariance was reached, hence, the parallel growth models were fitted using the mean scale scores for these constructs. For controlled motivation and amotivation, only partial measurement invariance was reached, therefore these growth trajectories were fitted using a multi-indicator growth model that allowed the modelling of the intercept variances (Coertjens et al., 2013). Figure 1 presents the structure of the multi-indicator parallel growth model, which was fitted for both controlled motivation and amotivation.

Firstly, it was determined which growth trajectory of self-efficacy was the most appropriate, and whether the growth trajectory of self-efficacy could be modelled simultaneously with the growth trajectory of the three different motivational constructs. For each type of motivation different parallel growth curve analyses (linear, quadratic and free time scores) were compared to each other.

The first parallel growth curve model estimated a *linear growth in self-efficacy*. The second model examined a *quadratic growth in self-efficacy*, the third model included a growth model with *free time score*s *for self-efficacy* and the final model include a *discontinuous piecewise growth model* dividing self-efficacy in secondary and higher education. Because both pieces only had two measurement moments the slope of both pieces needed to be fixed to 0. In order for the quadratic model to converge, the variance of the slope of self-efficacy also needed to be fixed to 0. The model fit for each model can be found in Table 5. For the model including self-efficacy and autonomous motivation, the results indicate that the model with free time scores for both motivation and self-efficacy yielded the best fit. In addition to having a lower fit than the free times scores model, the quadratic model was not selected because the quadratic slope was not significant (q = -.072, se = .054, p = .179). The discontinuous model showed a similar model fit, but the BIC value was higher and a such the free time scores model was preferred. An examination of the loadings of the indicators of the slope for self-efficacy shows that self-efficacy remains stable within the final year of secondary education and especially increases across the transition from secondary to higher education (see Table 6). For controlled motivation combined with self-efficacy, as well as amotivation combined with self-efficacy the analyses accounting for the nested structure did not converge (even after increasing the number of iterations) as such these relations could not be further explored.

Subsequently, we examined whether the development of autonomous motivation could be predicted by the development of self-efficacy. Figure 2 presents the schematic overview of the estimated parallel growth model, with self-efficacy predicting autonomous motivation (control variables were omitted in the figure for presentation purposes). The model fit of the parallel growth curve model with self-efficacy as a predictor for autonomous motivation was acceptable (χ^2 = 92.993, *df* = 27, CFI = .964, TLI = .952, RMSEA [CI 90%] = .062 [.049; .076], SRMR = .052, BIC = 7603.484). However, the reversed model in which autonomous motivation predicted self-efficacy showed a slightly better fit (χ^2 = 86.413, *df* = 27, CFI = .968, TLI = .957, RMSEA [CI 90%] = .059 [.045; .073], SRMR = .046, BIC = 7595.379). In terms of explained variance, autonomous motivation predicts respectively 16.5% and 57.7% of the intercept and slope variance of self-efficacy. While respectively only 13.5% and 33.4% of the variance in the intercept and slope of autonomous motivation is explained by self-efficacy.

Our model including the control variables also showed a good fit (χ^2 = 152.165, *df* = 76, CFI = .961, TLI = .953, RMSEA [CI 90%] = .040 [.031; .049], SRMR = .047, BIC = 7578.181). However, this model produced a warning that the standard errors might not be trustworthy due to a non-positive first-order product matric and that this was most likely due to the fact that the number of parameters exceeded the number of clusters minus the number of strata with more than one cluster. Consequently, we decided to remove all the non-significant control variables from the model. The final model predicting self-efficacy including type of secondary education and gender as a control variable for the slope of self-efficacy showed a good fit (χ^2 = 123.493, *df* = 43, CFI = .959, TLI = .949, RMSEA [CI 90%] = .055 [.043; .066], SRMR = .060, BIC = 7593.592). The results of this final model predicting the development of self-efficacy are presented in Table 7, and show that the slope

of the *growth* of self-efficacy is significantly predicted by the slope of the growth in autonomous motivation but not by the intercept of the growth in autonomous motivation. The development of autonomous motivation predicts the development in self-efficacy but the initial differences in autonomous motivation do not predict the development of self-efficacy. The initial differences in autonomous motivation do however predict the initial differences in self-efficacy. However, remarkably the covariance between the intercept and slope of self-efficacy is not significant. Regarding the control variables, the results showed that students from general secondary education have a stronger growth in self-efficacy in comparison with students from technical and vocational secondary education. Males also show a larger growth in comparison with females. The other control variables did not predict growth in self-efficacy significantly. None of the control variables significantly predicted the initial differences in self-efficacy. Further examination of the covariances revealed that the intercept and slope of autonomous motivation are negatively related to each other. Students with higher starting values have a smaller increase in motivation over time. In total, this model explains 16.5% (*se* = .040, $p < .001$) of variance in the intercept and 61.7% (*se* = .123, $p < .001$) of the variance in the slope capturing the development of self-efficacy.

Discussion

The current longitudinal study examined whether the development in self-efficacy explains the development in students' motivation across the transition from secondary to higher education. Despite theoretical expectations, the results of the current study do not provide support for the directional relationship between self-efficacy and autonomous motivation, as postulated by the self-determination theory and social cognitive theory (e.g., Alivernini & Lucidi, 2011; Bouffard et al., 2001; Ryan & Deci, 2000; Schüler et al., 2010). Rather, our results favour a reversed relationship: Autonomous motivation predicts self-efficacy. First,

students with higher autonomous motivation at the start of their final year of secondary education also reported higher values for self-efficacy at this time. This result is in line with prior research (e.g., Alivernini & Lucidi, 2011; Deci & Ryan, 2000; Schüler et al., 2010; Stajkovic & Luthans, 2003), but in itself cross-sectional in nature so in essence it does not provide information about the directionality of the relationship. However, our results also showed that the growth in autonomous motivation positively predicts the growth in self-efficacy and that this 'reversed' model is superior in terms of fit and explained variance to the hypothesized model. The fact that our findings contradict the theoretical expectations could be explained by the focus on learning. Schunk (1991) already stated that within educational contexts the influence of self-efficacy on motivational outcomes is more complex precisely due to the fact that learning is involved. He continues by stating that it seems reasonable that students with higher self-efficacy would invest effort in activities to increase their ability and performance. "In turn, these actions should produce better learning and substantiate students' efficacy' (Schunk, 1991, p. 222).

Despite its contribution, this study faces some limitations that may hinder the impact and generalizability of the results. Firstly, it focuses on a specific group of students; those progressing to higher education after graduating from secondary education. Students in higher education in Belgium are more diverse in comparison with samples from countries with highly competitive admissions systems and high tuition fees, therefore the results of the current study cannot necessarily be applied to other countries with different admissions policies. A study by Ratelle et al. (2004), for example, identified a minority group of students who encountered motivational problems in their first year at college. It would be interesting to see whether future research could examine whether these less optimal motivational patterns could explain drop-out rates within higher education.

Finally, besides controlling for students' socio-economic backgrounds and whether they came through the general or technical and vocational secondary education systems, no other personal characteristics of the students were taken into account. A study by Schüler et al. (2010) in the domain of sports, for example, identified that an individual's need for achievement moderates the relationship between self-efficacy and autonomous motivation. The relationship between self-efficacy and autonomous motivation is stronger for individuals with a high need for achievement (Schüler et al., 2010). Future research could explore whether this relationship can be replicated in the context of the transition from secondary to higher education.

Conclusion

The current study is one of the first to attempt to examine the development of academic motivation and self-efficacy across the transition from secondary to higher education using a longitudinal design. Moreover, it tries to unravel the complex relationship among these constructs. Results contradict the theoretically assumed relationship that self-efficacy would predict autonomous motivation and favours the opposite direction. However, further research is needed taking relevant personal resources as well as objective performance outcomes into account. Moreover, it would be interesting to examine the development patterns of students that do not enter or drop out of higher education. Next to the theoretical contribution, the current study also demonstrates the application (and opportunities) of advanced latent growth models taking the nested structure of the data into account.

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Table 1

Confirmatory Factor Analyses at Each Wave

Wave	χ^2	Df	CFI	RMSEA [CI 90%]	SRMR
1	704.39	129	.989	.084 [.078; .090]	.003
2	668.82	129	.992	.082 [.075; .088]	.000
3	829.27	129	.990	.097 [.091; .103]	.000
4	717.62	129	.992	.085 [.079; .091]	.000

Table 2

Measurement Invariance Over Time Self-Efficacy

Scale	Model					Model comparison			
		χ^2 (df)	CFI	RMSEA	BIC		$\Delta\chi^2$ (Δdf)	p-value	Δ CFI
Self-Efficacy	Model 1	209.629 (74)***	.963	.066 [.056; .077]	12719.471				
	Model 2 (equal loadings)	246.603 (83)***	.955	.068 [.059; .078]	12702.062	model 1 vs. 2	36.974 (9)	<.001	.008
	Model 3 (+equal intercepts)	255.561 (92)***	.955	.065 [.056; .075]	12656.636	model 2 vs. 3	8.958 (9)	.441	.000

Table 3

Descriptive Statistics Scales at each Wave

Scale	*N*	*M*	*SD*	*Cronbach's α*
W1 Autonomous	599	3.21	.73	.85
W2 Autonomous	551	3.26	.72	.82
W3 Autonomous	337	3.61	.74	.85
W4 Autonomous	398	3.61	.69	.82
W5 Autonomous	448	3.72	.68	.83
W1 Controlled	603	3.06	.75	.70
W2 Controlled	552	3.05	.75	.73
W3 Controlled	341	2.90	.85	.79
W4 Controlled	400	2.97	.83	.80
W5 Controlled	449	2.99	.86	.80
W1 Amotivation	604	1.87	.80	.77
W2 Amotivation	555	1.94	.85	.80
W3 Amotivation	339	1.45	.64	.76
W4 Amotivation	401	1.51	.76	.84
W5 Amotivation	450	1.47	.73	.87
W1 Self-efficacy	605	3.49	.78	.99
W2 Self-efficacy	553	3.52	.74	.99
W3 Self-efficacy	340	3.35	.82	.90
W4 Self-efficacy	397	3.38	.85	.99

Note: W = Wave; 5-point Likert scale.

Table 4

Correlations and Average Variance Explained Scales Wave 1

	Self-efficacy	Autonomous Motivation	Controlled Motivation	Amotivation
Self-efficacy	***.99***	.28**	-.03	-.22**
Autonomous Motivation		***.69***	.001	-.55**
Controlled Motivation			***.50***	.09*
Amotivation				***.73***

Note: Diagonal contains the square root of the Average Variance Extracted (facilitating the comparison with the correlations)
* p <.05, ** p <.01

Table 5

Model fit Parallel Latent Growth Models without Predictors

Model	CFI	TLI	RMSEA [95% CI]	χ^2	Df	BIC
Autonomous motivation						
Linear SE	.959	.948	.065 [.052; .079]	103.328	28	7610.081
Quadratic SE*	.964	.952	.063 [.049; .077]	93.864	27	7606.100
Free time scores SE	.970	.958	.059 [.045; .073]	82.196	26	7598.89
Piecewise discontinuous**	.970	.958	.058 [.044; .073]	81.428	26	7600.513

Note: SE = Self-efficacy
* Variance of the slope of SE fixed to 0
**Variance of the slopes of SE of both pieces fixed to 0

Table 6

Model Results Parallel Latent Growth Model Autonomous Motivation

Regression path		Estimate	Se	Critical ratio	P value (two-tailed)
i_{aut}					
	Autonomous wave 1	1.00	.00		
	Autonomous wave 2	1.00	.00		
	Autonomous wave 3	1.00	.00		
	Autonomous wave 4	1.00	.00		
	Autonomous wave 5	1.00	.00		
s_{aut}					
	Autonomous wave 1	.00	.00		
	Autonomous wave 2	.224	.137	1.637	.102
	Autonomous wave 3	1.598	.101	15.853	<.001
	Autonomous wave 4	1.823	.102	17.786	<.001
	Autonomous wave 5	2.080	.00		
i_{SE}					
	Self-efficacy wave 1	1.00	.00		
	Self-efficacy wave 2	1.00	.00		
	Self-efficacy wave 3	1.00	.00		
	Self-efficacy wave 4	1.00	.00		
s_{SE}					
	Self-efficacy wave 1	.00	.00		
	Self-efficacy wave 2	-.108	.185	-.582	.561
	Self-efficacy wave 3	1.252	.193	6.496	<.001
	Self-efficacy wave 4	1.50	.00		
Covariances					
s_{aut}	WITH i_{aut}	-.059	.015	-3.943	<.001
i_{SE}	WITH i_{aut}	.152	.029	5.285	<.001
	WITH s_{aut}	-.009	.013	-.695	.467
s_{SE}	WITH i_{aut}	-.055	.021	-2.696	.007
	WITH s_{aut}	.043	.009	4.514	<.001
	WITH i_{SE}	-.037	.023	-1.624	.104
Means					
i_{aut}		3.205	.040	80.459	<.001
s_{aut}		.226	.018	12.572	<.001
i_{SE}		3.495	.039	89.303	<.001
s_{SE}		-.109	.025	-4.371	<.001

Variances				
i_{aut}	.381	.032	11.990	<.001
s_{aut}	.056	.008	7.350	<.001
i_{SE}	.407	.030	13.501	<.001
s_{SE}	.063	.025	2.530	.011

Table 7

Model Results (Reversed) Parallel Latent Growth Model with Predictors

Regression path		Estimate	Se	Critical ratio	P value (two-tailed)
i_{aut}					
	Autonomous wave 1	1.00	.00		
	Autonomous wave 2	1.00	.00		
	Autonomous wave 3	1.00	.00		
	Autonomous wave 4	1.00	.00		
	Autonomous wave 5	1.00	.00		
s_{aut}					
	Autonomous wave 1	.00	.00		
	Autonomous wave 2	.196	.136	1.444	.149
	Autonomous wave 3	1.589	.102	15.533	<.001
	Autonomous wave 4	1.812	.102	17.818	<.001
	Autonomous wave 5	2.080	.00		
i_{SE}					
	Self-efficacy wave 1	1.00	.00		
	Self-efficacy wave 2	1.00	.00		
	Self-efficacy wave 3	1.00	.00		
	Self-efficacy wave 4	1.00	.00		
s_{SE}					
	Self-efficacy wave 1	.00	.00		
	Self-efficacy wave 2	-.061	.154	-.396	.692
	Self-efficacy wave 3	1.212	.160	7.580	<.001
	Self-efficacy wave 4	1.500	.00		
Regression paths					
s_{SE}	ON				
	s_{Aut}	.803	.148	5.440	<.001
	I_{Aut}	-.019	.039	-.458	.647
i_{SE}	ON				
	i_{Aut}	.424	.052	8.189	<.001
Control variables					
s_{SE}	ON				
	Sex	-.086	.039	-2.214	.027
	General secondary education	.143	.045	3.206	.001
Covariances					
s_{Aut}	WITH i_{Aut}	-.056	.015	-3.672	<.001

s_{SE} WITH i_{SE}	-.021	.017	-1.250	.211
Means				
i_{Aut}	3.208	.040	80.747	<.001
s_{Aut}	.225	.017	12.428	<.001
Variances				
i_{Aut}	.376	.031	11.981	<.001
s_{Aut}	.054	.007	7.236	<.001