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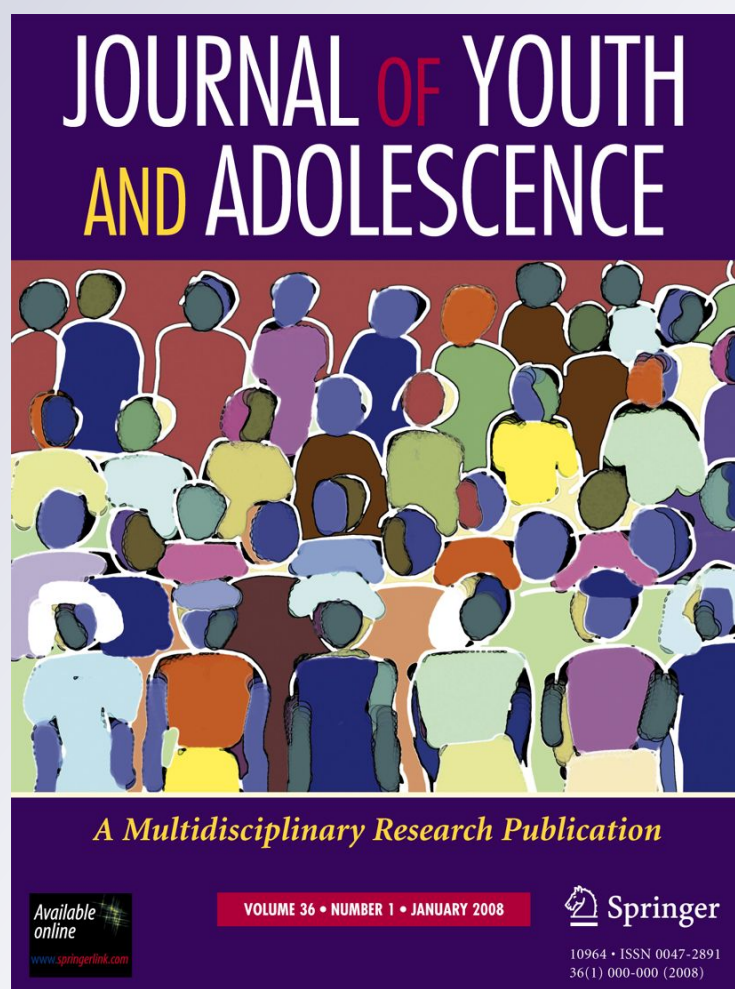
# *Personality Traits and Educational Identity Formation in Late Adolescents: Longitudinal Associations and Academic Progress*

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# Personality Traits and Educational Identity Formation in Late Adolescents: Longitudinal Associations and Academic Progress

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**Abstract** Changes in personality traits in late adolescence and young adulthood are believed to co-occur with changes in identity, but little research is available that supports this hypothesis. The present study addressed this relatively understudied area of research by examining longitudinal associations of Big Five personality traits (i.e., Neuroticism, Extraversion, Openness, Agreeableness, and Conscientiousness) with dimensions of identity formation (i.e., identification with commitment and exploration in depth) in the domain of education. For this purpose, we used four annual waves of longitudinal data on 485 Belgian late adolescents (87.4% female; mean age at T1 = 18.6 years) covering a 3-year period. Multivariate growth models revealed that changes in Big Five personality traits were related to changes in identification with commitment and exploration in depth. Cross-lagged panel models uncovered that, except for Openness, all Big Five traits predicted educational identity dimensions. Educational identity dimensions only predicted Neuroticism. In addition, adolescents with higher levels on the personality trait of Conscientiousness faced fewer study delays. In sum, the present study adds to the growing literature that explores the antecedents, correlates, and consequences of personality trait development by uncovering the interplay of personality traits, educational identity dimensions, and academic progress in late adolescents.

**Keywords** Five-factor model · Big five · Personality traits · Educational identity · Identity formation

## Introduction

The period extending from late adolescence into young adulthood is one of the best documented in research on personality trait development (Roberts et al. 2006). Despite a wealth of knowledge on personality trait development in this period, little is known about the antecedents, correlates, and consequences of changes in personality traits. Social investment theorists (e.g., Helson et al. 2002; Roberts et al. 2005) propose that personality trait changes should be related to investment in tasks of adult social life, such as the establishment of a career through engagement in education. In the current study, we attempt to test this assumption by examining longitudinal associations between personality traits, educational identity formation, and academic progress in a sample of late adolescent college students.

## Personality Traits and Social Investment

In the last decades, a majority of researchers has come to acknowledge that the higher-order structure of personality is adequately subsumed in five broad traits: The Big Five (Caspi et al. 2005). These five broad traits are Neuroticism (i.e., a tendency to experience distress), Extraversion (i.e., a tendency to enjoy attention and experience frequent positive moods), Openness (i.e., curiosity, creativity, imagination), Agreeableness (i.e., pro-social tendencies such as trust, compliance, and modesty), and Conscientiousness (i.e., the will to achieve and the ability to control one's impulses) (McCrae and Costa 1987; McCrae and John 1992). In a meta-analysis, Roberts et al. (2006) showed that

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the most prominent changes in personality traits tend to take place in the period from late adolescence to young adulthood (i.e., ages 18–22). In this period, individuals tend to decrease in Neuroticism and increase in Openness and the social dominance facet of Extraversion. The meta-analysis by Roberts et al. found no increases in Agreeableness and Conscientiousness. However, a more recent study did find substantive increases in these traits (Lüdtke et al. 2009). Thus, for all Big Five traits, there is at least some evidence for change in young adulthood.

Social investment theorists have proposed engagement and psychological investment in universal tasks of adult social life (e.g., establishing an occupational career or establishing a family) as a driving force behind personality-trait change (Helson et al. 2002; Roberts et al. 2005). That is, people are thought to construct personal identities by committing themselves to social roles of adult life. These social roles come with their own set of expectations. Living up to those expectations is likely to elicit social approval. Certain personality characteristics are thought to increase the likelihood that one lives up to those expectations. Specifically, high levels of Agreeableness, Conscientiousness and Extraversion, and low levels of Neuroticism are thought to be beneficial in this regard. Social Investment theorists state that individuals may change towards such a beneficial personality profile as a result of the pressure to adhere to social role expectations. As such, changes in Big Five personality traits may be explained by increased engagement and investment in these social tasks.

The social roles to which one is expected to invest are defined by age-specific social role expectations (e.g., Roberts et al. 2005). Late adolescents and young adults are expected to be engaged in relevant actions that contribute to the establishment of a career. For this purpose, many late adolescents are enrolled in college studies. The college setting comes with its own set of expectations, with adolescents, for example, being expected to invest time in the preparation for their exams. If one lives up to these expectations, one is more likely to experience approval. This approval may take the form of obtaining better grades, experiencing a better relationship quality with teachers, and, consequently, moving through one's study with fewer problems. However, the extent to which one is willing to live up to these social role expectations is largely determined by one's psychological commitment to this role. For that reason, commitment to roles is considered to be a crucial part of social investment (Lodi-Smith and Roberts 2007).

#### Personal Identity Formation: Linkages with Personality Traits

The process of committing to social roles, as described by social investment theorists, shares some similarities with

Erikson's (1968) conception of personal identity formation (Lodi-Smith and Roberts 2007). However, social investment theorists tend to overlook that there is more to personal identity formation than just the making of commitments. Elaborating on Erikson's theoretical writings, Marcia (1966) stated that personal identity formation is guided by the dimensions of commitment and exploration. In Marcia's definition, being committed with regard to one's education implies investing resources (e.g., time or money) in one's study. Marcia's (1966) definition refers to exploration as a process in which several alternative options are examined and compared. Thus, personal identity formation has long thought to be guided by commitment and exploration.

However, research on personal identity formation has strongly evolved in recent years (Meeus 2011), as it is now generally acknowledged that commitment and exploration are multifaceted constructs. Commitment can be unpacked into commitment making and identification with commitment. Commitment making refers to whether adolescents have made choices and engage in relevant activities toward the implementation of those choices. Hence, commitment making is similar to Marcia's original conceptualization of commitment. However, having commitments does not necessarily imply that one identifies him or herself with these commitments. Therefore, it is also important to distinguish an identification with commitment dimension. This dimension indicates to what extent adolescents identify themselves with, feel certain about, and internalize their commitments (Luyckx et al. 2006). Exploration is also split up in several dimensions. The extent to which different alternative identity options are explored and compared to one another is captured by exploration in breadth (Luyckx et al. 2008). In addition, existing commitments are also evaluated to make sure that they match the internal standards of a particular individual (Luyckx et al. 2008). That is, individuals can search for additional information about their current commitments, and reflect on them, and discuss them with relevant others. These evaluative processes are captured with the exploration in depth dimension (Klimstra et al. 2010; Luyckx et al. 2008; Meeus 1996). In sum, recent studies distinguish multiple commitment and exploration dimensions.

It has been argued that the more reflective processes of identification with commitment and exploration in depth may be more important from the college years onwards, whereas commitment making and exploration in breadth or reconsideration (i.e., comparing current commitments with possible alternatives) may be more important in early adolescence (Bosma and Kunnen 2008). In a longitudinal study, identification with commitment did not change substantially between ages 12 and 20, reconsideration decreased somewhat, and exploration in depth increased

toward late adolescence (Klimstra et al. 2010). In the college years, Luyckx et al. (2008) revealed that commitment making, identification with commitment, and exploration in depth increased. Thus, reflective processes indeed seem to become particularly important in the college years. Hence, because the present study samples college students, we focused on the identity dimensions of exploration in depth and identification with commitment.

Luyckx et al. (2006) examined how increases in these dimensions were intertwined with relative changes in personality traits. They found that identification with commitment was positively predicted by Conscientiousness, whereas exploration in depth was positively predicted by Neuroticism, Extraversion, and Conscientiousness. Conversely, identification with commitment predicted Neuroticism negatively and Conscientiousness positively. Exploration in depth negatively predicted Openness. As such, there appears to be strong interplay between personality traits and identity dimensions.

However, as a test of the social investment model, the study by Luyckx et al. (2006) is less than ideal because it focused on global identity dimensions instead of specific identity domains. Therefore, it is unclear whether personal identity formation with regard to occupation, relationships, education, or politics was related to changes in personality traits. Because the amount of identity commitment and exploration can differ from one domain to another (Goossens 2001), more detailed studies that relate personality traits to one identity domain at a time are needed for a thorough test of the social investment model.

#### Toward More Specificity: Personality Traits and Educational Identity Formation

In the present study, we provided a domain-specific focus by examining one of the most salient life domains for adolescents, namely education (Kalakoski and Nurmi 1998). The importance of psychological investment in the educational domain is not restricted to adolescence, as education can be considered a means for implementing occupational choices (Lent et al. 1994). Therefore, it is an integral part of career development (Super 1980) and an important determinant of occupational identity formation (Skorikov and Vondracek 2011).

Personality traits already have been shown to be related to educational identity formation in a series of cross-sectional studies. It should be noted that these studies employed broad commitment measures in which identification with commitment and commitment making were not measured separately. Similarly, exploration measures are mixes of exploration in breadth and depth. Higher scores on Neuroticism and lower scores on Conscientiousness were associated with less career exploration (Reed et al.

2004; Tokar et al. 1998), and less commitment (Germeijs and Verschueren 2011; Page et al. 2008). Unfortunately, these cross-sectional studies merely indicated that personality traits and educational identity formation were associated at a particular point in time. It remains unclear whether changes in personality traits coincide with changes in educational identity dimensions. To infer whether this was the case, the present study employed longitudinal data in a first attempt to examine associations between the developmental trajectories of personality traits and educational identity dimensions.

With cross-sectional studies, it also remains unclear whether individuals with specific personality characteristics are more likely to invest psychologically in their education, or whether investing in one's education may change one's personality. To gain insight in the direction of effects between personality traits and educational identity formation, longitudinal studies are needed. To the best of our knowledge, there have been no such studies until now. Therefore, the present study provided a first longitudinal examination of the direction of effects between personality traits and educational identity formation.

#### Personality Traits, Educational Identity Formation, and Academic Success

Although it is important to examine the interplay between personality traits and educational identity dimensions, we previously noted that social investment is also about actually having a role. In other words, it is also important to explore the practical implications of personality traits (e.g., Roberts et al. 2007) and educational identity dimensions (Germeijs and Verschueren 2007). Because the present study focuses on the domain of education, we examined whether personality traits and educational identity dimensions predict success in academia. A direct indicator of success in the academic setting is academic progress (i.e., whether individuals progress through a study in a normative way or face delays). For that reason, we examined whether personality traits and educational identity dimensions predict academic progress.

Both personality traits and educational identity dimensions previously have been linked to academic progress or related constructs. For identity, these studies again relied on broad measures of commitment (i.e., mixes of identification with commitment and commitment making) and exploration (i.e., mixes of exploration in breadth and depth). These studies showed that educational commitment predicts academic achievement (i.e., whether individuals succeeded, took all exams but failed, or stopped before participating in all exams during their first year in college), as individuals lower in commitment were more likely to discontinue their study than those exhibiting high levels of

commitment (Germeijs and Verschueren 2007). Similarly, a meta-analysis revealed that individuals with higher levels of institutional commitment (i.e., confidence and satisfaction with their current college institution) were more likely to remain enrolled in a college study (Robbins et al. 2004). Finally, another meta-analysis revealed that Conscientiousness is also consistently related to academic progress (O'Connor and Paunonen 2007). However, all the aforementioned studies focused either on educational identity dimensions or on personality traits. As a result, it is unclear whether personality traits exert unique effects on academic progress above and beyond the effect of educational identity dimensions, and whether educational identity dimensions exert unique effects on academic progress above and beyond the effects of personality traits. To the best of our knowledge, the present study was the first to examine the unique effects of personality traits and educational identity dimensions on academic progress.

### The Present Study

The main purpose of the present study was to examine social investment in the educational domain, by exploring longitudinal linkages between personality traits and educational identity formation. For this purpose, we first examined how developmental trajectories of personality traits and educational identity dimensions were related. Second, the direction of effects between personality traits and educational identity dimensions was inferred. Third, we examined which were the best predictors of academic progress: personality traits or educational identity dimensions. All these three research questions are discussed below. It should be noted that hypotheses regarding these research questions are mostly tentative, because research on longitudinal relationships between personality traits and identity formation in the specific domain of education is lacking. In addition, most previous studies relied on broad measures of commitment (i.e., mixes of identification with commitment and commitment making) and exploration (i.e., mixes of exploration in breadth and depth), whereas we provide more specificity by only focusing on the parts of these dimensions that are most salient for late adolescents (i.e., identification with commitment and exploration in depth, respectively; Bosma and Kunnen 2008; Klimstra et al. 2010).

For the first research question, we examined relations between underlying developmental trajectories of personality traits and educational identity dimensions by means of Latent Growth Curve Models (LGCM; Duncan et al. 1999). In such models, a distinction is made between levels (i.e., intercepts) and rates of change (i.e., slopes) of variables, which are both modeled as latent factors. As such, correlations between these latent factors for personality traits

and educational identity represent correlations between the underlying developmental trajectories of these variables. Our primary focus will be on the correlations between latent slope factors, because these associations are thought to be indicative of overlapping developmental trends (Duncan et al. 1999). Moreover, associations between developmental trends of educational identity dimensions and personality traits have not been examined before. Still, we can provide tentative hypotheses regarding our first research question. Based on social investment theory and findings obtained in previous cross-sectional work (Germeijs and Verschueren 2011; Page et al. 2008), we expected identification with educational commitments to be positively associated with Extraversion, Agreeableness, and Conscientiousness, and negatively associated with Neuroticism. For educational in-exploration in depth, social investment theory offers no hypotheses. However, based on cross-sectional studies on career exploration (Germeijs and Verschueren 2011; Reed et al. 2004; Tokar et al. 1998), we expected educational exploration in depth to be positively associated with Conscientiousness and negatively associated with Neuroticism.

The LGCMs that were employed to pursue our first research question cannot be used to infer whether personality traits predict educational identity dimensions, or whether it is the other way around. Therefore, our second research question focused on the direction of effects in the interplay of personality traits and educational identity dimensions by means of cross-lagged panel models (Burkholder and Harlow 2003). These models, in which within-time correlations and the relative stability of the constructs of interest are controlled for, are ideally suited to infer whether personality traits predict educational identity dimensions, whether educational identity dimensions predict personality traits, or whether there is a reciprocal process in which relative changes in personality traits and educational identity dimensions mutually reinforce one another. Regarding this second research question, we cannot provide clear-cut hypotheses because the direction of effect between educational identity dimensions and personality traits has not been previously assessed. Moreover, theoretical models provide conflicting hypotheses. That is, some theoretical models place the Big Five traits at the core of personality, generally assuming that these broad dispositions can predict more specific adaptations such as (educational) identity dimensions (Asendorpf and van Aken 2003; McAdams and Olson 2010; McCrae and Costa 1999). On the other hand, social investment theorists see psychological investment in social tasks of adult life (and, hence, the identity dimension of identification with commitment) as a driving force behind personality change (Lodi-Smith and Roberts 2007). Therefore, they suggest that identity formation might drive changes in personality traits, especially

in Agreeableness, Conscientiousness, Neuroticism, and Extraversion. Previous empirical work by Luyckx et al. (2006) suggests that there is some truth in both explanations, as they uncovered a transactional process in which personality traits predicted identity dimensions, but identity dimensions also predicted personality traits. Unfortunately, Luyckx et al. focused on global identity which makes it unclear to what extent their findings apply to the specific domain of education. As such, it is unclear what we should expect with regard to our second research question.

With our third research question, we explored the possible associations of educational identity dimensions and personality traits with academic progress (i.e., whether or not adolescents progress through their study at a normal pace). Previous studies that considered either personality traits or educational identity dimensions (Germeijs and Verschueren 2007; O'Connor and Paunonen 2007; Robbins et al. 2004) allowed us to hypothesize that individuals with lower levels of identification with educational commitments and lower levels on the personality trait of Conscientiousness would be more likely to face study delays.

## Method

### Participants and Procedure

Participants were drawn from the Leuven Trajectories of Identity Development Study (L-TIDES; Luyckx et al. 2006), a 7-wave longitudinal study on late adolescent college students from the faculty of Psychology and Educational Sciences at a large Belgian university. Data on both the Big Five personality traits and identity formation were available for four measurement waves. Consequently, these four waves were used for the present study. There was a 1-year interval between each of these four measurement waves. Adolescents had just started with their first year in college at the first measurement wave, and were, if they progressed at a normative pace through their studies, in their fourth year at the final measurement wave.

Permission to undertake this study was granted by the Institutional Review Board within the researchers' department. Participants signed a standard consent form before participating in the first wave of data collection. During the consent process, participants were informed that they could refuse or discontinue participation at any time. All participants were assigned a unique code number to ensure confidentiality. At each measurement time, questionnaires were distributed in lecture halls or by mail, and participants were asked to complete the questionnaires as soon as possible. This request was repeated 2 weeks later. Three weeks after administration, a new questionnaire was sent to those who had not yet returned the questionnaire.

At Time 1, all first-year student from the faculty of Psychology and Educational Sciences ( $N = 638$ ) were invited to participate. Of these students, 88.6% ( $N = 565$ ; 85.3% female;  $M_{age} = 18.66$  years;  $SD = .63$ ) participated. Among these 565 participants, 81.9% reported coming from an intact two-parent family, 14.9% indicated that their parents had divorced, 2.3% indicated that one of their parents had deceased, and 0.9% indicated that their family structure was not described by the previously mentioned options. It may be pointed out here that Luyckx et al. (2006) used a limited portion of the dataset that was employed in the current study.

As in many longitudinal studies, data were missing at different time points for different participants. Only individuals who participated in at least two out of four measurement waves ( $N = 485$ ; 87.4% female;  $M_{age} = 18.63$  years;  $SD = .61$ ) were included. Of these 485 individuals, 83.5% came from intact two-parent families, 13.4% reported that their parents had divorced, 2.1% indicated that one of their parents had deceased, and 1.0% reported another family situation. A Chi-square test indicated that relatively more girls than boys participated in more than one measurement wave ( $p < .001$ ), whereas an analysis of variance indicated that individuals who participated in just one measurement wave were older than those who participated in two or more measurement waves ( $p = .021$ ). There were no differences in family structure between those who participated in just one measurement wave and those who participated in multiple measurement waves. A Multivariate Analysis of Variance (MANOVA) also indicated no significant differences in personality traits and identity dimensions between those who participated in just one measurement wave and those who participated in multiple measurement waves ( $p = .099$ ).

Overall, 12.50% of the data were missing for the 485 participants that were included in our analyses. Participants with and without complete data were compared using Little's (1988) Missing Completely At Random (MCAR) test. This yielded a normed  $\chi^2$  ( $\chi^2/df$ ) of 1.39 which, according to guidelines provided by Bollen (1989), indicates a good fit between sample scores with and without imputation. Therefore, missing values were dealt with using the full-information maximum likelihood (FIML) procedure for all primary analyses (Allison 2003; Schafer and Graham 2002).

### Measures

#### *Personality Traits*

Personality traits were measured with the Dutch version of the well-established 60-item NEO Five-Factor Inventory (NEO-FFI; Costa and McCrae 1992; Hoekstra et al. 1996). The NEO-FFI aims to measure the Big Five personality traits of Neuroticism (i.e., the tendency to experience



distress), Extraversion (i.e., the tendency to experience positive emotions), Openness (i.e., tendencies related to curiosity, creativity, and imagination), Agreeableness (i.e., attributes that foster positive relationships with others, like helpfulness and cooperativeness), and Conscientiousness (i.e., organizational and goal-directed aspects of behavior) (Caspi et al. 2005; McCrae and John 1992). All traits are measured with 12 items each. For sample items, the reader is referred to the NEO-FFI manual (Costa and McCrae 1992). Cronbach's alphas obtained in the current study are presented in Table 1.

*Educational Identity Formation*

Educational identity formation was measured with the Utrecht-Groningen Identity Development Scale (Meeus and Dekovic 1995). This 10-item measure was originally developed for use with Dutch-speaking adolescents to assess identification with commitment and exploration in depth with 5 items each. All items were answered on a 5-point Likert-type rating scale, ranging from 1 ('completely untrue') to 5 ('completely true'). Sample items for identification with commitment are "My education gives me certainty in life" and "My education gives me self-confidence". Sample items for exploration in depth are "I try to figure out regularly what other people think about education" and "I often reflect on my education". Meeus (1996) and Meeus and Dekovic (1995) have provided evidence for the factorial structure of the U-GIDS and its invariance across various Dutch-speaking samples. Meeus et al. (2002) provide an overview of the instrument's concurrent and construct validity. Cronbach's alphas obtained in the current study are presented in Table 1.

*Academic Progress*

To measure academic progress, we assessed whether participants advanced to the next year of their study and thus progressed normally, or whether they failed to progress normally due to failure to pass exams or switching from one major to another. We used this information to create variables that indicated whether or not individuals advanced to the next year of their study during the preceding year (i.e., during the interval between the previous measurement wave and the present measurement wave), or not. Because participants could only be delayed from Time 2 onwards, we created such variables for measurement Time 2, Time 3 and Time 4.

**Results**

To examine our three research objectives, we employed four annual waves of data on personality traits and

**Table 1** Descriptive statistics, reliability, and within-time correlations

	Descriptive statistics				Within-time correlations at T1 and T4												
	T1 M (SD)	T2 M (SD)	T3 M (SD)	T4 M (SD)	Reliability		T1	T2	T3	T4	Neu	Ext	Op	Ag	Con	Com	Exp
Neu	2.91 (.63)	2.86 (.65)	2.87 (.61)	2.81 (.56)	.87	.88	.89	.89	.89	–	–.35***	–.06	–.23***	–.25***	–.19***	–.19***	.03
Ext	3.63 (.49)	3.63 (.49)	3.60 (.44)	3.61 (.41)	.80	.82	.81	.82	.82	–.49***	–	–.13**	.31***	.19***	.17***	.13**	.13**
Op	3.46 (.45)	3.46 (.46)	3.49 (.45)	3.51 (.40)	.71	.71	.75	.73	.73	–.01	.07	–	–.02	–.01	–.06	–.06	.08
Ag	3.74 (.40)	3.73 (.39)	3.74 (.37)	3.80 (.33)	.69	.70	.73	.71	.71	–.42***	.42***	.05	–	.29***	.09*	.09*	.10*
Con	3.41 (.48)	3.41 (.50)	3.45 (.49)	3.53 (.46)	.79	.81	.83	.84	.84	–.37***	.27***	–.12**	.31***	–	.27***	.27***	.28***
Com	3.34 (.58)	3.37 (.59)	3.43 (.63)	3.51 (.61)	.84	.82	.87	.86	.86	–.35***	.27***	.10*	.18***	.38***	–	–	.23***
Exp	3.57 (.48)	3.63 (.51)	3.71 (.51)	3.76 (.51)	.62	.60	.64	.65	.65	.10*	.16**	.06	.00	.17**	.20***	–	–

T1 within-time correlations are shown above the diagonal, T4 within-time correlations appear below the diagonal  
 Neu neuroticism, Ext extraversion, Op openness, Ag agreeableness, Con conscientiousness, Com identification with commitment, Exp exploration in depth  
 \*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

educational identity dimensions. Sample means as well as within-time correlations between all the study variables at the first and last measurement waves are shown in Table 1. This table reveals that the pattern of within-time correlations remained largely stable across the timespan of our study.

Associations Between Mean Levels and Changes in Personality Traits and Identity Dimensions

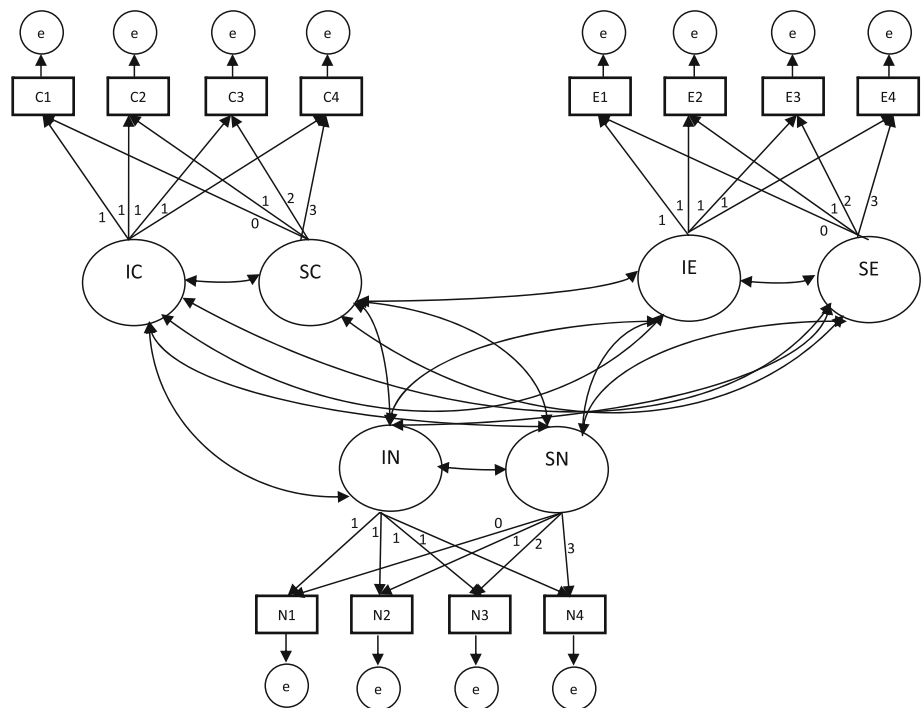
Our first research question was to examine what the associations between mean levels and changes in personality traits and identity dimensions looked like. For this purpose, we ran multivariate Latent Growth Curve Models (LGCM; Duncan et al. 1999) in *Mplus* 4.0 (Muthén and Muthén 2006). In such models, mean levels (i.e., intercepts) and rates of change (i.e., slopes) are calculated on the basis of individual growth trajectories for all participants. We used Maximum Likelihood Robust (MLR) estimation, which provides the most robust estimate of model fit and model parameters (Satorra and Bentler 1994). We controlled for sex by including this variable as a covariate in all models. Model fit was judged by assessing the Chi-square, the Comparative Fit Index (CFI), and the Root Mean Square Error of Approximation (RMSEA). CFIs larger than .90 and RMSEAs smaller than .08 are indicative of an adequate model fit, whereas CFIs larger than .95 and RMSEAs smaller than .05 signify a good fit (Hu and Bentler 1999;

Kline 2005). For model comparisons, we relied on Chi-square difference tests (Satorra and Bentler 2001).

We ran five multivariate growth models. In each of these models, we modeled two educational identity dimensions (i.e., identification with commitment and exploration in depth) with one Big Five personality trait. Thus, we ran a model with identification with educational commitments, educational exploration in depth, and Neuroticism, another one with identification with educational commitments, educational exploration in depth, and Extraversion, and so on. A sample model is shown in Fig. 1. Fit indices, growth parameters, and associations between intercepts and slopes of the various models are shown in Table 2. Means and variances of intercepts and slopes of identification with commitment and exploration in depth appear in the note under this table.

Table 2 reveals that higher intercepts and larger slopes of Neuroticism were related to lower intercepts and smaller slopes of identification with commitment, respectively. Positive correlations were found for intercepts of Extraversion, Agreeableness, and Conscientiousness with intercepts of identification with commitment. In addition, slopes of Extraversion, Agreeableness, and Conscientiousness were positively associated with slopes of identification with commitment. Intercepts of Extraversion, Openness, Agreeableness, and Conscientiousness were positively associated with intercepts of exploration in depth. Slopes of Openness and Conscientiousness were positively associated with slopes of exploration in depth.

**Fig. 1** Sample multivariate growth model for identification with commitment (C1–C4, C1 is identification with commitment at Time 1, C2 is identification with commitment at Time 2, etcetera), exploration in depth (E1–E4), and Neuroticism (N1–N4). *IC* intercept for identification with commitment, *SC* slope for identification with commitment, *IE* intercept for exploration in depth, *SE* slope for exploration in depth, *IN* intercept for Neuroticism, *SN* slope for Neuroticism. In the other models, Neuroticism was replaced by the other Big Five traits



**Table 2** Fit indices, growth parameters, and intercept and slope associations of big five personality traits with educational identity dimensions

Personality traits	Model fit statistics				Growth parameters		Ic–Ic associations		SI–SI associations	
	$\chi^2$	<i>df</i>	CFI	RMSEA	Intercept <i>M</i> ( $\sigma^2$ )	Slope <i>M</i> ( $\sigma^2$ )	Com	Exp	Com	Exp
Neuroticism	111.382***	57	.967	.044	2.91*** (.29***)	-.03*** (.02***)	-.38***	.03	-.41***	-.03
Extraversion	103.912***	57	.969	.041	3.63*** (.19***)	-.01 (.01***)	.33***	.20**	.50***	.11
Openness	83.049*	57	.984	.031	3.46*** (.16***)	.02* (.01***)	-.03	.16*	.04	.21*
Agreeableness	108.563***	57	.965	.043	3.72*** (.10***)	.02*** (.01***)	.23***	.20***	.31*	.04
Conscientiousness	135.245***	57	.952	.053	3.39*** (.17***)	.04*** (.01***)	.43***	.47***	.52**	.43**

Intercept means and variances (between parentheses) for identification with commitment and exploration in depth were, 3.33\*\*\* (.17\*\*\*) and 3.58\*\*\* (.12\*\*\*), respectively. Slope means and variances (between parentheses) for identification with commitment and exploration in depth were .05\*\*\* (.02\*\*\*) and .05\*\*\* (.02\*\*\*), respectively

*df* degrees of freedom, *CFI* comparative fit index, *RMSEA* root mean square error of approximation, *Ic* intercept, *SI* slope, *Com* identification with commitment, *Exp* exploration in depth

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

### Direction of Effects Between Personality Traits and Identity Dimensions

To infer the second research question, whether personality traits predicted identity dimensions, or identity dimensions predicted personality traits, we ran ten cross-lagged panel models, with one Big Five trait and one identity dimension per model. Each model contained 4 consecutive measurement waves of a Big Five personality trait and an educational identity dimension. Big Five personality traits and educational identity dimensions were modeled as latent variables.

Using items as indicators of latent variables can lead to overly complex models with a large number of parameters to be estimated. To reduce the number of indicators of a latent variable to the optimal number of three for each latent construct and thereby reduce model complexity (Little et al. 2002), it has been recommended to use parcels consisting of multiple items instead of using individual items (e.g., Marsh and Hau 1999). We used the well-established item-to-construct balance parceling method (Little et al. 2002) to create three four-item parcels per Big Five trait. Each of the identity dimensions was split up in one one-item parcel and two two-item parcels.

The estimated models contained stability paths of a personality trait and an identity dimension, within-time associations between variables (which should be interpreted as correlated relative change at Time 2, Time 3, and Time 4; Klimstra et al. 2010), and cross-lagged paths from the personality trait to the identity dimension and from the identity dimension to the personality trait. To make the models as parsimonious as possible, we attempted to constrain within-time associations indicative of correlated relative change (i.e., the within-time associations at Time 2, Time 3, and Time 4) and cross-lagged paths to be time-invariant. That is, we constrained, for example, the Time 2 association between

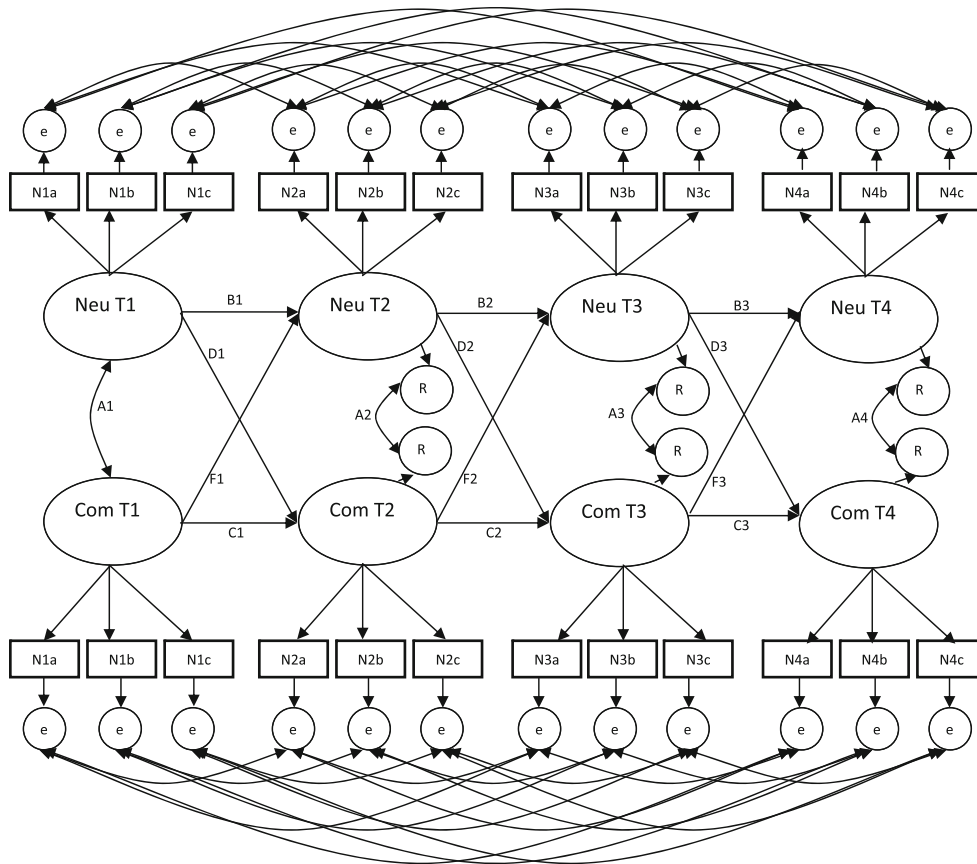
Extraversion and identification with commitment to be equal to the Time 3 and Time 4 associations between these two variables, and constrained the cross-lagged path from Time 1 exploration to Time 2 Agreeableness to be equal to the cross-lagged paths from Time 2 exploration to Time 3 Agreeableness, and Time 3 exploration to Time 4 Agreeableness. A sample model is shown in Fig. 2.

To examine whether adding such time-invariance constraints was justified, we compared the fit of models in which such constraints were added (i.e., constrained models) to models in which such constraints were not added (i.e., unconstrained models). Non-significant Chi-square difference tests for all model comparisons indicated that adding these constraints was justified (see Table 3). The resulting model parameter estimates are presented in Table 4 (stability paths, initial correlations, and correlated relative change) and Table 5 (cross-lagged effects). The stability paths for the identity dimensions appear in the footnote under Table 4.

Table 4 reveals substantial stability of personality traits and identity dimensions, with personality traits appearing to be more stable across time than identity dimensions. Because correlations of personality traits with educational identity dimensions have been discussed previously, we will not discuss T1 correlations and correlated relative change. Therefore, we now proceed to the cross-lagged paths.

Table 5 shows that identification with commitment negatively predicted levels of Neuroticism, but was also negatively predicted by Neuroticism. A non-significant Chi-square difference test ( $p > .05$ ) revealed that paths in both directions were equally strong. There were no significant cross paths from exploration in depth to Neuroticism, or the other way around.

Extraversion was a significant positive predictor of identification with commitment and exploration in depth,



**Fig. 2** Sample cross-lagged model of Neuroticism (Neu T1–Neu T4) and identification with commitment (Com T1–Com T4). Personality (i.e., Neuroticism) and identity (i.e., identification with commitment) are indicated by three parcels each, at each of the measurement occasions. Specifically, Neuroticism at Time 1 is indicated by parcels n1a, n1b, and n1c, Neuroticism at T2 is indicated by parcels n2a, n2b, and n2c, and so on. Over-time correlations between errors (indicated with *e*) of identical parcels (e.g., correlations between n1a and n2a, n2a and n3a, n3a and n4a, n1a and n3a, n2a and n4a, and n1a and n4a) were allowed. The most important associations estimated with the

model were within-time correlations (i.e., associations A1–A4), stability paths of Neuroticism (i.e., B1, B2, and B3) and identification with commitment (i.e., C1, C2, and C3), cross-lagged paths from Neuroticism to identification with commitment (i.e., D1, D2, and D3), and cross-lagged paths from commitment to Neuroticism (i.e., F1, F2, and F3). It may further be noted that within-time correlations at Time 2, Time 3, and Time 4, are actually correlations between residual variances (i.e., signified with Rs). Therefore, these correlations should be interpreted as correlated relative change (e.g., Klimstra et al. 2010)

whereas the paths in the inverse direction were not significant (see Table 5). Chi-square difference tests revealed that the paths from Extraversion to identification with commitment and exploration in depth were stronger than the non-significant paths in the inverse direction ( $p = .028$  and  $p < .001$ , respectively).

There were no significant cross-paths from exploration in depth and identification with commitment to Openness, or the other way around (see Table 5). Agreeableness was a positive predictor of identification with commitment, but not of exploration in depth. Chi-square difference tests indicated that the path from Agreeableness to identification with commitment was stronger than the non-significant ones in the opposite direction ( $p = .022$ ).

Table 5 reveals that Conscientiousness was a positive predictor of identification with commitment and exploration in depth, whereas cross paths in the opposite direction

did not reach significance. Chi-square difference tests indicated that paths from Conscientiousness to identification with commitment and exploration in depth were significantly stronger than the paths in the inverse direction ( $p < .001$  and  $p = .003$ , respectively).

#### Personality Traits, Educational Identity, and Academic Progress

Our third research questions focused on whether personality traits or educational identity dimensions could independently predict academic progress. We operationalized academic progress as study delay, and examined whether educational identity dimensions and personality traits could predict study delay by means of a survival analysis technique (i.e., Cox regression; Cox 1972). In the model, we used all available information on study delay (i.e.,

**Table 3** Comparisons of fit for unconstrained (no time-invariance) and constrained models (time-invariant correlations and cross-lagged paths)

	Unconstrained models				Constrained models				Chi-square difference test		
	$\chi^2$	df	CFI	RMSEA	$\chi^2$	df	CFI	RMSEA	$\Delta\chi^2$	$\Delta df$	p
<b>Id. with commitment models</b>											
Neuroticism	312.920***	216	.985	.030	315.498***	222	.986	.029	2.578	6	.919
Extraversion	280.037**	216	.988	.025	284.723**	222	.989	.024	4.686	6	.716
Openness	271.795**	216	.989	.023	272.728*	222	.990	.022	.933	6	.992
Agreeableness	246.035	216	.993	.017	249.005	222	.994	.016	2.970	6	.875
Conscientiousness	499.423***	216	.961	.052	505.190***	222	.961	.051	5.767	6	.677
<b>Exploration in depth models</b>											
Neuroticism	265.835**	216	.990	.022	275.261**	222	.990	.022	9.426	6	.221
Extraversion	266.118*	216	.988	.022	271.272*	222	.989	.021	5.154	6	.593
Openness	308.738***	216	.976	.030	318.069***	222	.975	.030	9.331	6	.317
Agreeableness	257.571*	216	.986	.020	266.245*	222	.985	.020	8.674	6	.298
Conscientiousness	317.233***	216	.976	.031	319.606***	222	.977	.030	2.383	6	.945

Id. with Commitment, identification with commitment

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

**Table 4** Estimated stability paths and within-time correlations

Variable	Stability paths			Within-time correlations							
	T1–T2	T2–T3	T3–T4	T1		T2		T3		T4	
				Com	Exp	Com	Exp	Com	Exp	Com	Exp
Neuroticism	.77***	.81***	.78***	-.26***	-.01	-.10***	-.02	-.09***	-.02	-.09***	-.02
Extraversion	.83***	.83***	.84***	.22**	.24**	.07**	.05*	.06**	.05*	.06**	.05*
Openness	.88***	.89***	.92***	-.02	.17*	.03	.07**	.03	.05**	.03	.06**
Agreeableness	.75***	.84***	.81***	.16**	.19*	.05	.03	.05	.02	.05	.03
Conscientiousness	.85***	.90***	.88***	.35***	.38***	.13***	.10***	.11***	.08***	.11***	.08***

Com identification with commitment, Exp exploration in depth

Stability paths for identification with commitment ranged from .50 to .54 between T1 and T2, from .65 and .68 between T2 and T3, and from .70 to .72 between T3 and T4 across models ( $ps < .001$ ). Stability paths for exploration in depth ranged from .57 to .60 between T1 and T2, from .57 and .61 between T2 and T3, and from .68 to .72 between T3 and T4 across models ( $ps < .001$ )

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

**Table 5** Cross-lagged effects of educational identity dimensions on personality traits and of personality traits on educational identity dimensions

	Identity dimensions on personality traits						Personality traits on identity dimensions					
	Identification with commitment			Exploration in depth			Identification with commitment			Exploration in depth		
	T1–T2	T2–T3	T3–T4	T1–T2	T2–T3	T3–T4	T1–T2	T2–T3	T3–T4	T1–T2	T2–T3	T3–T4
Neu	-.06*	-.06*	-.06*	.00	.00	.00	-.09**	-.08**	-.08**	.05	.04	.04
Ext	.01	.01	.01	-.01	-.02	-.02	.08**	.08**	.07**	.08*	.08*	.08*
Op	.01	.01	.01	-.05	-.05	-.06	.03	.02	.03	.02	.02	.02
Ag	.04	.04	.04	-.02	-.02	-.02	.10**	.08**	.09**	.04	.03	.03
Con	-.01	-.01	-.01	-.05	-.05	-.05	.11***	.11***	.13***	.09*	.08*	.10*

Neu neuroticism, Ext extraversion, Op openness, Ag agreeableness, Con conscientiousness

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

measured at Times 2, 3, and 4, respectively) as the dependent variable, whereas sex and age, educational identity dimensions, and personality-trait data gathered during the preceding measurement waves (i.e., Times 1, 2, and 3, respectively) were entered stepwise as predictors.

In the first step, we entered sex and age. Age did not have a significant effect on study delay, but sex did. A hazard ratio (which is basically an odds ratio) of .697 (95% Confidence Interval (CI) = .495, .980;  $p = .038$ ) indicated that boys were more likely to experience study delays than girls were.

The second step consisted of adding educational identity dimensions to the equation. Our results indicated that identification with commitment was a significant predictor of study delay, whereas the effect of sex was no longer significant (hazard ratio = .723; 95% CI = .511, 1.024;  $p = .068$ ). For identification with commitment, a hazard ratio of .763 (95% CI = .626, .929;  $p = .007$ ) indicated that less committed individuals were more likely to face study delays.

Personality traits were added in the third step. After adding the Big Five personality traits, the effect of identification with commitment was no longer significant (hazard ratio = .856; 95% CI = .689, 1.063;  $p = .159$ ). Conscientiousness did turn out to be a significant predictor of study delays. A hazard ratio of .674 (95% CI = .517, .879;  $p = .004$ ) indicated that the less conscientious adolescents were, the more likely they were to face study delays.

## Discussion

Investment in social roles of adult life, such as the establishment of a career, is thought to be related to personality change in adolescence and young adulthood (e.g., Roberts et al. 2005; Lodi-Smith and Roberts 2007). The present study examined this assertion in the important domain of education, by exploring the interplay between personality traits, educational identity dimensions, and academic progress. Although there had been a number of previous studies on this topic (e.g., Germeijs and Verschueren 2007, 2011; O'Connor and Paunonen 2007; Page et al. 2008; Reed et al. 2004; Robbins et al. 2004; Tokar et al. 1998), none of those studies addressed these linkages between personality traits and educational identity dimensions longitudinally. In addition, it had never been formally tested whether personality traits or educational identity dimensions were the best predictors of academic progress. In the present study, we overcame these limitations by employing longitudinal data from four waves with 1-year intervals. Our findings revealed that developmental trajectories of educational identity dimensions and personality traits were

interrelated, and that personality traits appeared to be better predictors of educational identity dimensions than the other way around. In addition, the personality trait of Conscientiousness was the only significant predictor of academic progress with unique predictive power beyond four other personality traits and both educational identity dimensions. All our findings extend previous knowledge on social investment education in important ways, as our prospective longitudinal design allowed us to gain insights that could not be gained with cross-sectional data.

## Associations Between Developmental Trajectories of Personality Traits and Educational Identity Dimensions

In line with theoretical propositions by social investment theorists (Lodi-Smith and Roberts 2007) and previous cross-sectional work (Germeijs and Verschueren 2011; Page et al. 2008), we found that initial levels of identification with educational commitments were positively associated with initial levels of Extraversion, Agreeableness, and Conscientiousness, and negatively associated with initial levels of Neuroticism. The present study moved beyond previous work, by uncovering linkages between developmental trajectories of educational identity dimensions and personality traits. Specifically, larger increases (or smaller decreases, depending on whether an individual displayed an increase or a decrease) in identification with educational commitments were associated with larger increases (or smaller decreases) in Extraversion, Agreeableness, and Conscientiousness. In addition, larger increases (or smaller decreases) in identification with educational commitments were associated with larger decreases (or smaller increases) in Neuroticism. Thus, our findings reveal that changes in identification with commitment are linked to changes in the same four traits that have been associated with social investment (Lodi-Smith and Roberts 2007), suggesting that the social investment perspective holds longitudinally for the educational domain.

Personality traits were also associated with educational exploration in depth. Initial levels of Conscientiousness were positively associated with initial levels of educational exploration in depth, confirming findings obtained in previous studies (Germeijs and Verschueren 2011; Reed et al. 2004; Tokar et al. 1998). In addition, larger increases (or smaller decreases) in educational exploration in depth were associated with larger increases (or smaller decreases) in Conscientiousness. Contrary to what we expected based on research on career exploration, initial levels and change rates of Openness were positively associated with initial levels and change rates of educational exploration in depth. However, it should be noted that these associations were

rather small. In fact, within-time associations between Openness and educational exploration in depth failed to reach significance (see Table 1). Finally, we found unanticipated positive associations of initial levels of educational exploration in depth with initial levels of Extraversion and Agreeableness. Change rates of these two personality traits were, however, not associated with change rates of educational exploration in depth. Thus, Conscientiousness is the only personality trait with clear linkages with initial levels and changes in educational exploration in depth. Further research is needed to clarify the small role we found for Openness, Extraversion, and Agreeableness.

#### Direction of Effects Between Personality Traits and Educational Identity Dimensions

With regard to our second research question (i.e., direction of effects between personality traits and educational identity dimensions), our findings did not confirm the social investment principle (e.g., Lodi-Smith and Roberts 2007; Roberts et al. 2005) that committing to social roles of adult life may drive changes in personality traits. Specifically, we found only one significant effect of educational identity dimensions on personality traits, and far more significant effects (i.e., 6 out of 10 possible effects) in the inverse direction. Moreover, there were five paths from personality traits to educational identity that were significantly stronger than those in the inverse direction in 5 cases. Conversely, paths from educational identity to personality traits were never significantly stronger than the ones in the inverse direction.

Thereby, our findings were more in line with the general assumption upheld in different theoretical models that place the Big Five at the core of personality. A key assumption of such models is that these core traits are more likely to predict more specific adaptations (such as educational identity) than the other way around (Asendorpf and van Aken 2003; McAdams and Olson 2010; McCrae and Costa 1999). Although our findings appear to favor models that distinguish core traits and specific adaptations over the social investment principle, it should be noted that we only focused on the domain of college education. Therefore, we only focused on the college years. In that period in the lifespan, many individuals have not yet made definite commitments to adult roles like career establishment (Arnett 2000). Thus, although education is an inherent part of one's professional career (Skorikov and Vondracek 2011), committing to education may not quite have the impact on personality traits that committing to an actual job may have. Therefore, further research may support the social investment principle rather than models that distinguish core traits and specific adaptations.

Several traits appeared to be important predictors of educational identity dimensions. Extraversion predicted a stronger sense of identification with educational commitments. Extraverted individuals are known to experience more positive emotions (Caspi et al. 2005; Costa and McCrae 1995). As a consequence of experiencing more positive emotions in general, they may also evaluate their current choice of education more positively. Agreeableness also predicted a stronger sense of identification with educational commitments. These results may suggest that a general sense of trust (which is a facet of the broader trait of Agreeableness; Costa and McCrae 1995) fosters faith in one's current choice of education, reflected by an increased identification with one's commitments. Indeed, a previous study found systematic linkages between parent- and peer-related trust on the one hand, and identification with commitment on the other hand (Meeus et al. 2002). With regard to our explanations of the effects of both Extraversion and Agreeableness on identification with commitment, it should be noted that future studies are needed to infer whether the aforementioned facets indeed predict identification with commitment, or whether other facets are also involved.

We found positive associations of Conscientiousness with both identification with commitment and exploration in depth. This may seem counterintuitive as these identity dimensions have to some extent been operationalized as antithetical variables (e.g., Marcia 1966). However, as noted, we examined one specific type of exploration, namely exploration in depth (Luyckx et al. 2006; Meeus 1996). As mentioned in the introduction of the present study, this type of exploration refers to a thorough reflection on the merits of one's current commitments. Given this definition of exploration, it makes perfect sense that conscientious individuals, who have the capacity to control their impulses, a strong tenacity of goal pursuit, and the tendency to be planful (Caspi et al. 2005; Denissen and Penke 2008), are more likely to feel certain about and stick to their current choices with regard to education (i.e., indicated by high levels of educational commitment), and to thoroughly reflect on their commitments (i.e., indicated by high levels of educational exploration).

The fact that exploration in depth is predicted by Conscientiousness, but also by Extraversion, may also be explained by the idea that the interpersonal context affects identity development (e.g., Kerpelman et al. 1997; Lichtwarck-Aschoff et al. 2008). Exploration in depth may involve gathering information about one's current commitments from others (Meeus et al. 2010). The interpersonal component of exploration in depth may explain its associations with Extraversion and Conscientiousness. That is, these traits have been found, or have been theorized, to be of great importance in friendship formation

(Extraversion; Selfhout et al. 2010), and the maintenance of friendships (Conscientiousness; e.g., Graziano and Eisenberg 1997; Jensen-Campbell and Malcolm 2007).

A personality trait with a less interpersonal connotation, Neuroticism, was also associated with educational identity formation dimensions. That is, we uncovered transactional linkages between identification with commitment and Neuroticism. These transactional processes indicated that committed individuals were likely to become less neurotic, and more neurotic people were likely to become less committed. Thus, our results suggest that a sense of sameness and continuity as indicated by strong identification with commitments (Erikson 1968) may both facilitate and be facilitated by the ability to deal with stress in an effective manner as indicated by low Neuroticism.

#### Personality Traits and Educational Identity Dimensions as Predictors of Academic Progress

Our third objective was to examine the relationships of these two constructs with academic progress (i.e., whether one advances through a study at a normal pace, or faces delays). In line with previous research (Germeijs and Verschueren 2007; Robbins et al. 2004), we found that adolescents who identified themselves more strongly with their educational commitments were less likely to face study delays. However, when the Big Five personality traits were entered into the equation, the effect of identification of commitment was no longer significant. Instead, the personality trait of Conscientiousness turned out to be the only significant predictor. That is, in line with a meta-analysis (O'Connor and Paunonen 2007), our findings indicated that more planful, orderly, responsible, and persistent individuals (which are all characteristics subsumed under the broader trait of Conscientiousness; Caspi et al. 2005) were less likely to face study delays. Furthermore, our findings suggest that the effect of identification with commitment on academic progress can to some extent be explained by the overlap of Conscientiousness and identification of commitment. Still, there was a significant trend indicating that identification with commitment positively predicted academic progress after Conscientiousness was added to the equation. Therefore, our study suggests that identification with commitment and Conscientiousness are related constructs with more or less similar effects on academic progress.

#### Implications

The present study illustrated the utility of personality traits in predicting important life outcomes. Therefore, our work can be considered as an extension of previous work by Roberts et al. (2007), who summarized the results of a large

number of studies that related personality traits to important objective outcomes like mortality, divorce, and occupational outcomes. However, they did not consider dimensions of identity formation as predictors of these outcomes whereas the current study did. Although the effects of these identity dimensions (i.e., identification with commitment) only signified a statistical trend in the present study, studies focusing on other life domains may yield different results. Therefore, we argue for considering identity dimensions in addition to personality traits when examining effects on important life outcomes.

At a more practical level, our results suggest that the personality trait of Conscientiousness and, to a lesser extent, identification with educational commitments deserve the attention of educational professionals like teachers and educational counselors. Primary schools, high schools, and college could perhaps devote more attention to the skills associated with Conscientiousness. These skills include persistency, responsibility, order, and the capacity to plan ahead (e.g., Caspi et al. 2005). It has been argued that personality traits like Conscientiousness are difficult to modify, but specific behaviors associated with these traits should be more open to change (McCrae and Costa 1999). In order to identify the specific Conscientiousness-related behaviors that are most important with regard to academic progress, it may be necessary to design studies that distinguish between different facets of Conscientiousness (i.e., competence, order, dutifulness, achievement striving, self-discipline, and deliberation; Costa and McCrae 1995). Thus, our study reveals that Conscientiousness deserves attention from educational professionals, but does not clarify whether some facets of this trait may be more important than others in predicting academic progress.

#### Limitations and Suggestions

Several limitations need to be acknowledged in addition to the limitations that already have been recognized in previous sections of this discussion. The composition of our sample is a first limitation, as it is composed of late adolescents majoring in Psychology and Educational Sciences. In such majors, women tend to be relatively overrepresented. As such, 85% of our participants were female. Although this sex distribution is representative for Belgian psychology majors (e.g., Luyckx et al. 2006), our results are perhaps less generalizable to men, to adolescents majoring in other subjects, or to high school adolescents. We attempted to account for the overrepresentation of women by controlling for sex in all analyses. Still, replication of our findings in more representative samples is warranted.

Second, our study was restricted to one specific European country: Belgium. It should be noted that college



education is similar across Europe to allow adolescents to move from one university to another. In the last decade, European college education has also become increasingly similar to college education in North America. Still, each culture has its own peculiarities, which may have their unique effects on associations between variables. Therefore, McAdams and Pals (2006) recognized culture as an important “factor” of personality. In line with this proposition, culture has been found to moderate associations of personality traits with well-being (e.g., Klimstra et al. 2011). Likewise, culture might affect associations between personality traits, educational identity formation, and academic progress as well. For that reason, culture should be considered as a moderator of the associations between personality traits, educational identity dimensions, and academic progress in future studies.

A third limitation concerns our reliance on self-report measures to assess personality traits and educational identity. For identity formation, self-reports are the only reliable source, as the construct itself is thought to represent an individual's own sense of commitment and exploration (Erikson 1968). For personality traits, other-reported measures are available, but a recent study has shown that such other-reported data might be as informative about the raters' personality traits as they are about the personality traits of the person being rated (Wood et al. 2010). Thus, despite their limitations, self-reports are still among the best measures to assess identity dimensions and personality traits.

Fourth, we included a limited number of educational identity dimensions. Although there are theoretical reasons (Bosma and Kunnen 2008) and there is empirical evidence (Klimstra et al. 2010; Luyckx et al. 2008) that strongly suggests that commitment making and exploration in breadth may be of lesser importance in late adolescence, it would still have been better to include these dimensions in the present study. Unfortunately, the dataset that we employed in the present study did not include commitment making and exploration in breadth in the specific domain of education.

A final limitation concerns our measure of academic progress. Our measure merely indicated whether an adolescent had progressed to the subsequent year or not for each of the measurement waves. There are many possible reasons why adolescents would not progress to the subsequent year that are not all necessarily related to their academic abilities. Therefore, future studies should seek to include data on more specific measures of academic progress (e.g., the amount of received course credit, exam results (i.e., failure, pass, re-examination), and GPA).

Despite the above limitations, the present study provides important new insights in social investment and achievement in one of the key life domains of late adolescence and

young adults: education. Specifically, the present study is the first to uncover that developmental trajectories of personality traits and educational identity dimensions are interrelated, with personality traits being more consistent predictors of educational identity dimensions than the other way around. Another important contribution is that the personality trait of Conscientiousness was the only significant predictor of academic progress when all Big Five personality traits and two educational identity dimensions are considered. The role of identification with educational commitment, which was an important predictor of academic progress in previous studies (Germeijs and Verschueren 2007; Robbins et al. 2004), appeared to be rather limited when Conscientiousness was accounted for. In sum, the present study extends the existing literature on personality traits, educational identity dimensions, and academic progress, by providing a longitudinal perspective on their interplay.

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