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Direction of Associations between Personality Traits and Educational Identity Processes:

Between- and Within-Person Associations

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Data availability statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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The authors report no conflict of interests.

Ethical approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed consent

Informed consent was obtained from all participants included in the study.

Abstract

Introduction: In adolescence, personality traits and educational identity processes are interwoven. Previous studies have shown that personality traits predict healthy identity commitment and exploration in education. However, the direction of associations between personality traits and an identity process that searches for another identity option (i.e., reconsideration of commitment) is unclear. Furthermore, there is a lack of prospective studies regarding the direction of the association between personality traits and educational identity process using within-person methods. Therefore, this study examined the direction of these associations. **Methods:** Participants of this four-wave longitudinal study comprised 618 Japanese 13-year-old adolescents (53.3% girls). This study involved a one-year-interval assessment. **Results:** Cross-lagged panel models (CLPM) indicated that four personality traits (neuroticism, agreeableness, and conscientiousness) predicted three educational identity processes, while reconsideration of commitment predicted two personality traits (i.e., neuroticism and conscientiousness). Random intercept cross-lagged panel models (RI-CLPM) indicated that agreeableness predicted healthy commitment, while commitment predicted agreeableness at within-person level. **Conclusion:** The findings from CLPM suggest that reconsideration of commitment is significant factor to predict healthy (i.e., conscientiousness) and unhealthy (i.e., neuroticism) personality traits in individual differences. Furthermore, the findings from RI-CLPM suggest that agreeableness may be a key trait in promoting healthy educational identity commitment. Theoretical and practical implications of these findings are discussed.

Keywords: personality traits, educational identity process, longitudinal, between-person effects, within-person effects.

Direction of Associations between Personality Traits and Educational Identity

Processes: Between- and Within-Person Associations

Introduction

The self is a complex system consisting of multiple layers (McAdams & Zapata-Gietl, 2015). The first layer comprises individuals' social roles and expectations, and is the relatively stable self that includes personality traits (e.g., Big Five; Caspi et al., 2005). The second layer represents the self that is motivated by individuals' intentions, and it corresponds to the identity process of exploring and committing to identity-related plans, values, and goals (Erikson, 1959; Marcia, 1966). Both layers change throughout an individual's life span (McAdams & Pals, 2006). How are these two layers interwoven in young people?

In early adolescence (i.e., around the ages of 12–15 years), young people face rapid biological, cognitive, and social changes (Kroger et al., 2004). Prompted by these multiple changes, adolescents face the challenge of developing their personality and identity with regard to multiple domains (e.g., Crocetti, 2017, 2018). Education is a core identity domain given the centrality of the school experience for early adolescents (Meeus et al., 1999). Educational identity comprises goals, values, and choices that people define, endorse, and follow in their educational context (Negru-Subtirica & Pop, 2018). In modern society, early adolescents explore their educational identity in secondary school and the academic level and type of schooling (e.g., technical, agricultural, and so on) that they choose to attend is important for their future vocational identity (Côté, & Levine, 2016; Negru-Subtirica et al., 2018). Hence, it is essential to uncover the mutual influence of personality traits and educational identity processes to understand early adolescent self-development. This longitudinal study sought to address this aspect by examining the direction of the associations between personality traits and educational identity processes among early adolescents while

also differentiating the effects occurring at the between-persons level and those operating at the within-persons level—in line with recent advances in self-related literature (e.g., Bogaerts et al., 2019; Mercer et al., 2017; Negru-Subtirica et al., 2020).

Change in Personality Traits During Early Adolescence

The core personality traits are typically captured by the Big Five (Caspi et al., 2005). The Big Five personality traits include neuroticism (the tendency to be vulnerable to anxiety and depression), extraversion (the tendency to be assertive, active, and sociable), openness (curiosity and interest in the unknown), agreeableness (the tendency to engage in prosocial behavior), and conscientiousness (the will to control one's plans and achievements) (Caspi et al., 2005).

Previous longitudinal research has tackled two types of changes in personality traits during early adolescence. The *rank-order stability*, which refers to the maintenance of individuals' relative standing on a trait dimension within a population over time, increases from early to late adolescence (Klimstra et al., 2018). Meanwhile, the *mean-level change*, which refers to the change in the average trait levels of a population over time, has been characterized by a less clear pattern in early adolescence. One study showed results of decreased agreeableness and openness from childhood to adolescence (Göllner et al., 2017). Another study reported little change in all the personality traits throughout adolescence (Elkins et al., 2017). These findings suggest that while both rank-order and mean-level changes in personality traits occur during early adolescence, the mean-level changes are less consistent.

Changes in personality traits are strongly related to the maintenance or change of an individual's goals (e.g., Robert, 2004). When seeking to maintain current goals, individuals try to be emotionally stable (opposite of neurotic tendencies), more diligent and cooperative in the current environment, and when pursuing new goals, they try to be more extroverted

and open to the environment (De Young, 2015). In the educational setting, learning more, trying to be competent compared to others, and getting good grades are important educational goals for early adolescents (Wentzel, 1993; Shim, Ryan, & Anderson, 2008). To achieve these goals, young people plan well, but also change their plans more flexibly. In this regard, conscientiousness and openness play an important role in high test scores and academic performance (Israel et al., 2019; McGeown et al., 2014; for a meta-analysis, see Poropat et al. 2009). Therefore, the traits related to the maintenance and modification of goals are particularly relevant to the achievement of educational goals.

Change in Educational Identity Processes During Early Adolescence

Educational goals are strongly related to one's career choices and identity, and not merely to good grades and praise from teachers and parents. These goals and academic performance determine the destination of higher education and occupation. Therefore, identity researchers have focused on the educational identity processes that shape the goals, and values that young people investigate and then follow (Negru-Subtirica & Pop, 2018).

Educational identity processes can be studied by applying the three-identity process model (Crocetti et al., 2008). This model advanced the identity status paradigm proposed by Marcia (1966) by conceptualizing identity as an iterative dynamic, in which individuals can form their identity and over time question or consolidate it (Crocetti, 2017). Identity formation and consolidation cycles are based on the interplay between three identity processes (Meeus, 2011, 2018). Commitment refers to enduring choices that individuals make regarding their beliefs, and the self-confidence derived from their choices. In-depth exploration refers to the extent to which individuals actively think about their identity commitments by gathering information and talking with others about their commitment. Reconsideration of commitment refers to the process of searching for another identity option when a current commitment in beliefs, values, and plan is no longer satisfactory; thus, it

involves both vulnerability for loss of identity and potential for further development of identity.

Previous longitudinal studies have examined changes in educational identity processes, in addition to personality traits, during early adolescence. A study highlighted that rank-order stability for educational identity processes increased from early to middle adolescence (Mercer et al., 2017), and another study showed that mean-level change for all identity processes increased during early and middle adolescence (Hatano et al., 2020). These findings suggest that both rank-order and mean-level changes occur in educational identity processes during early adolescence.

Direction of Associations Between Personality Traits and Educational Identity Processes

How do personality traits and educational identity processes influence each other in early adolescence? Theoretically, different directions of the effects can be hypothesized. On the one hand, considering that, within the self, personality traits are considered to form a more stable layer than identity processes (McAdams & Zapata-Gietl, 2015), it is possible to expect a predominant direction from personality to identity processes. In this regard, personality traits can drive identity process-related changes over time, as more stable components of the self are expected to affect less stable components; this is in line with the distinction between the core and surface characteristics of the self (e.g., Kandler et al., 2014; Asendorpf & Van Aken, 2003).

On the other hand, in line with the social investment theory, personality traits may change over time because of changes in individuals' commitments to social roles and institutions (Roberts et al., 2005). According to social investment theory, young adults change their personality traits the most as they are triggered by many novel situations and try to invest in age-graded social roles, such as work, family, and relationships with loved ones (Wrzus & Roberts, 2017). By investing in new social roles, they internalize desirable goals

and rules of those roles and change personality traits accordingly. Although social investment theory mentions young adults, it seems to be applicable for early adolescents, who are required to invest in roles that come with the changing environment. Early adolescents experience a major environmental change of transitioning from elementary to middle school (Theriot & Dupper, 2010). They adapt to the new educational setting and, in doing so, internalize its rules (e.g., Crone & Fuligni, 2020). Under this line of thinking, when early adolescents invest more in their role as students (e.g., increasing their educational commitment), such a change can trigger their personality formation (Negru-Subtirica et al., 2020). They tend to pursue goals based on personality traits simultaneously (Klimstra et al., 2018). Thus, theoretically, personality traits and educational identity processes can affect each other over time.

Thus far, any empirical evidences for testing these theoretical hypotheses have been limited. One longitudinal study examined the direction of associations between personality traits and educational identity processes in late adolescence (Klimstra et al., 2012). In this study, agreeableness and conscientiousness positively predicted commitment, while extraversion and conscientiousness positively predicted in-depth exploration. Furthermore, commitment and neuroticism were negatively related to each other. These results suggest that personality traits generally predict educational identity processes rather than the other way around.

However, Klimstra et al. (2012) used only commitment and in-depth exploration in their work; therefore, the direction of the associations between personality traits and the process that is more strongly involved in identity changes (i.e., reconsideration of commitment) remained unclear. Reconsidering commitment represents the process of giving up on the educational value after being disappointed by the current situation (i.e., psychologically negative aspects) and exploring new possibilities (i.e., psychologically

positive aspects) (Crocetti et al., 2008). Therefore, it may be positively associated with extraversion and openness, which are qualities that seek to change the environment.

Furthermore, reconsidering commitment is also intertwined with anxiety about maintaining the present situation (Crocetti et al., 2008). Therefore, it could be positively associated with neuroticism and negatively associated with agreeableness and conscientiousness. Thus, to further advance our understanding of the relationship between personality traits and educational identity processes, it is important to consider multiple processes (i.e., commitment, in-depth exploration, and reconsideration of commitment) and focus on early adolescence.

Disentangling between-person and within-person effects

In recent years, research on personality and identity has devoted increasing attention to the necessity of differentiating between-person effects from within-person effects (e.g., Hatano et al., 2020; Kroencke et al., 2021). Between-person models provide information about rank-order stability within a group over time. More specifically, a between-person model focuses on the effects between two variables by comparing the individuals' scores in relation to others' scores in the same sample. On the other hand, within-person models provide evidence of temporary fluctuations between two variables within one person. Thus, a within-person model could provide information about the effects of focusing on changes in scores of individuals. Between- and within-person associations are clearly distinguished from each other, which means that their directions can differ (e.g., Negru-Subtirica et al. 2020; Orth et al. 2020).

However, previous research examining the direction of associations between personality traits and educational identity processes (Klimstra et al., 2012) focused only on the between-person level. Thus, the direction of associations between these variables at the within-person level remains unclear. Specifically, for the social investment theory, the process

by which educational goals and values are internalized by individuals seems to occur mainly at the within-person level rather than at the between-person level, because the internalization of values occurs within the individual, not in group dynamics (e.g., Crone & Fuligni, 2020). Therefore, to uncover the process of internalizing others' perspectives into self-formation, examination at the within-person level is required. In this study, we addressed this gap by examining the interplay between personality traits and educational identity processes in early adolescence at both (between- and within-person) levels.

Japanese Educational Context in Early Adolescence

Educational setting is strongly related to the system and culture of the corresponding country (Erentaitė et al., 2018). The current study was conducted in Japan, a country with a cultural mix of individualism and collectivism (Sugimura, 2020). In Japan, education is compulsory up to secondary school, with 5- to 12-year old students in elementary school, and 13- to 15-year old students in middle school. Given the current rate of 98.8% students entering high school (Statistics Bureau of Japan, 2020), it can be said that most middle school students become high school students. Except in certain cases, middle school rules are stricter than those of elementary schools (e.g., required to wear uniforms). Additionally, learning has become more advanced and the need to study diligently has become mandatory for students. Approximately more than 60% of middle school students attend private lessons outside of schools in order to get good grades and clear the entrance examination to high school (Ministry of Education, Culture, Sports, Science and Technology, 2018). Thus, the transition from elementary to junior high school is a major change in environment for the adolescents in Japan. In order to adapt this significant change, young people may internalize educational rules and goals and act on them. Therefore, it would be expected that educational commitment is related to agreeableness and conscientiousness at the within-person level.

The Present Study

This study examined the direction of associations between personality traits and educational identity processes at the between- and within- person levels. Concerning the direction of effects, we separately hypothesize about the between- and within- person levels. At the between-person level, the results of previous study mainly support the finding that personality traits predict educational identity (Klimstra et al., 2012); therefore, in the present study, we also predict that personality traits affect the educational identity process. Based on these theoretical assumptions and previous finding, we propose the following hypotheses: we expect that neuroticism will positively predict reconsideration of commitment (Hypothesis 1); extraversion and openness will positively predict reconsideration of commitment (Hypothesis 2); agreeableness and conscientiousness will positively predict commitment (Hypothesis 3); agreeableness and conscientiousness will negatively predict the reconsideration of commitment (Hypothesis 4). Furthermore, we expect that extraversion, and conscientiousness will positively predict in-depth exploration (Hypothesis 5).

The within-person level has not yet been examined. According to the social investment theory, active involvement in student roles leads to within-individual changes in personality traits. Specifically, the relationship between educational commitment, agreeableness, and conscientiousness is expected to be significant in the Japanese educational context. Therefore, the association between personality traits and identity processes may be bi-directional at within-person level. We expect that neuroticism and reconsideration of commitment will positively predict each other (Hypothesis 6); extraversion, openness, and reconsideration of commitment will positively predict each other (Hypothesis 7); agreeableness, conscientiousness, and commitment will positively predict each other (Hypothesis 8); agreeableness, conscientiousness, and reconsideration of commitment will negatively predict each other (Hypothesis 9). Furthermore, we expect that extraversion, conscientiousness, and in-depth exploration will positively predict each other (Hypothesis

10).

Method

Participants and Procedure

Data were obtained from the Japanese Longitudinal Identity Research Project (Hatano & Sugimura 2017; Hatano et al. 2020), which consisted of four waves conducted from March 2013 to March 2016 with one-year assessment intervals. In this project, data were collected using an online research company (MACROMILL: <http://www.macromill.com/>). This survey targets minors under the age of 18. However, because the minors cannot register with the research company, the online research company contacted the parents or guardians via email, and matched registrants (i.e., those who [1] have Japanese nationality, [2] are currently living in Japan, and [3] have a child aged 13 years old at the first wave [T1]) received an e-mail describing the research purposes. If they wanted their child to participate, the parents or guardians signed an informed consent agreement. In this process, they were explained that the survey was conducted anonymously. After providing consent, parents or guardians received an e-mail containing a hyperlink to the web-based survey, and they let their children answer. After completing the questionnaire, parents or guardians received reward points equivalent to 50 JPY (approximately 0.50 USD).

Six-hundred eighteen Japanese adolescents (51.3% girls) aged 13 years participated in the first wave. Seventy-two percent of participants lived in the Kanto, Chubu, and Kansai metropolitan districts (i.e., urban areas in eastern, central, and midwestern Japan, respectively). The remaining participants lived in the Hokkaido, Tohoku, Chugoku, Shikoku, and Kyushu districts (i.e., relatively rural areas). Regarding household income, 20.4% had low income (i.e., less than 2 million yen), 61.8% had middle income (i.e., 2-8 million yen), and 7.6 % had high income (i.e., over 8 million yen), and the income of 5% was unknown. The participants were followed until they were aged 16 years with one-year intervals. At T2,

T3, and T4, 438 (52.8% girls), 357 (52.9% girls), and 212 (50.5% girls) participants, respectively, provided data. At T1, participants were first-graders in three-year junior high schools, and at T4, 94.8% of the 16-year-old participants attended high school.

Two hundred twelve participants completed all four waves, resulting in 65.7% data loss between T1 and T4. A MANOVA was conducted to examine whether there were differences in T1 personality traits and educational identity processes between participants who responded to all surveys and those who had deficits (Wilks's $\lambda=0.971$; $F(8, 609)=0.023$; $p=0.538$, $\eta^2=0.029$). Participants who responded to all surveys tended to score higher on T1 commitment and T1 openness than those who did not [for commitment, $F(1, 616)=5.188$; $p=0.023$, $\eta^2=0.008$]; for openness, $F(1, 616)=7.295$; $p=0.007$, $\eta^2=0.012$]. However, the effect sizes were small (Cohen, 1988). Additionally, Little's (1988) missing completely at random test was performed to examine if there was a pattern in the missing data, which indicated that the data were probably missing completely at random [$\chi^2(128) = 127.443$, $p = .50$].

Measures

Personality Traits

The Big Five personality traits were assessed using the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992; for the Japanese version see Yoshimura et al., 1998). This measure consists of 60 items assessing Big Five personality traits (12 items for each subscale) rated on a 5-point Likert scale from 1 (*completely untrue*) to 5 (*completely true*). The five traits are neuroticism, extraversion, openness, agreeableness, and conscientiousness.

Educational Identity Process

Educational identity processes were assessed using the Utrecht-Management of Identity Commitments Scale (U-MICS; Crocetti et al., 2008; for the Japanese version see Hatano et al., 2016). This measure consists of 13 items assessing educational identity processes rated on a 5-point Likert scale ranging from 1 (*completely untrue*) to 5 (*completely*

true). Commitment was assessed with five items (e.g., “My education gives me certainty in life”), in-depth exploration was assessed with five items (e.g., “I think a lot about my education”), and reconsideration of commitment was assessed with three items (e.g., “I often think it would be better to try to find a different education”).

Statistical Analysis

Analyses of structural equation models were conducted using the *Mplus* 8.4 program. Full Information Maximum Likelihood (FIML) was used for dealing with missing values, and the maximum likely robust estimation method was employed. As a preliminary step, longitudinal measurement invariance analysis was conducted to test whether the model of personality traits and identity processes were equivalent across time. For the measurement invariance test in personality traits, the parceling approach (in a random fashion) was used. Parceling is recommended in situations where the scale has more than five items for each construct, and the sample size is large (Bagozzi & Heatherton, 1994). Using a large number of indicators in confirmatory factor analyses often results in a large number of correlated residuals, which decreases both the fit of the model and the utility of the latent variable in capturing the construct of interest (Marsh et al., 1998). Thus, parcels of items for each construct were constructed and used as indicators of the latent variables.

Because latent constructs should have the same meaning across waves (Schmitt & Kuljanin, 2008), configural invariance and metric invariance models were compared. Model comparisons were conducted considering differences in fit indices. For optimal model fit, the comparative fit index (CFI) should exceed .95, with values higher than .90 considered acceptable, and the root mean square error of approximation (RMSEA) should be less than .05, with values less than .08 representing reasonable fit (Kline, 2015), and the standardized root mean-square residual (SRMR) should be less than .08 representing reasonable fit (Byrne, 2012). To test whether the fit of the model was equivalent across time,

the Satorra–Bentler χ^2 difference test (S-B χ^2) (Cheung & Rensvold, 2002), differences in CFI (Δ CFI), RMSEA (Δ RMSEA), SRMR (Δ SRMR), and Akaike information criteria (AIC; Δ AIC) between models were used. If the differences in model fit indices exceeded the following criteria, the null hypothesis of invariance was rejected: significant changes in S-B χ^2 at $p < .05$, Δ CFI $\geq -.010$, Δ RMSEA $\geq .015$, Δ SRMR $\geq .030$, and Δ AIC ≥ 20 (Burnham & Anderson, 2002; Cheung & Rensvold, 2002; Kline, 2015).

To disentangle the direction of associations between personality traits and educational identity processes at the between-person level, the standard cross-lagged panel model was used (CLPM; Little, 2013). Regarding the directions of associations between them at the within-person level, a random intercept-cross lagged panel model was tested (RI-CLPM; Hamaker et al., 2015). This modeling approach differs from typical CLPM by including random intercepts for the levels of all personality traits and educational identity processes to capture stable individual differences between early adolescents. That is, for each construct of personality traits and educational identity processes, the individual has an expected score, which is based on the sample mean across four years. This score represents the individual's stable trait factors as the random intercept. Furthermore, the variance at the within-person level captures early adolescents' year-to-year fluctuations relative to their own expected score. Thus, by separating stable individual differences in personality traits and educational identity processes between early adolescents from within-person variances, it is possible to investigate how within-person changes in personality traits and educational identity processes are associated over time. Most importantly, the cross-lagged parameter reflects whether an adolescent's deviation from his or her expected score can be predicted by the adolescent's deviation from his or her own score on the previous wave in the RI-CLPM (Hamaker et al. 2015).

In the CLPM and RI-CLPM, four types of models were tested: a fully unconstrained

model as a baseline model (Model 1); a constrained model for all stability paths to be equal across four waves (Model 2); a constrained model for all stability and cross-lagged paths to be equal across four waves (Model 3); and a constrained model for all stability and cross-lagged paths across four waves and within-time correlations at T2, T3, and T4 to be equal (Model 4). When conducting analysis in CLPM and RI-CLPM, models that constrain stability and cross-lagged paths are desirable in terms of parsimony (Orth et al., 2020). Therefore, constrained models were used as much as possible.

Results

Descriptive Statistics and Measurement Invariance

Means and standard deviation values, and Cronbach's α coefficients are presented in Table 1. The α coefficients of openness were low (.40–.51) (See Supplementary Material for details on gender differences and scoring).

Measurement invariance tests were conducted for each variable in personality traits and educational identity processes. The latent variables consisted of three parcels for the personality traits. For agreeableness, since the solutions did not converge into three parcels, the latent variables consisted of four parcels. As shown in Table S3, the configural invariance results for openness did not meet the CFI's criteria ($>.90$). Because of problems in terms of internal consistency and stability of the factor structure, we excluded openness from further analysis. With respect to four personality traits other than openness and identity processes, metric invariance could be established.

Personality Traits and Educational Identity Processes: Between- and Within-Person Associations

To examine the direction of associations between personality traits and educational identity processes, CLPM and RI-CLPM were conducted. In the CLPM, all variables were modelled as observable variables. Table S4 presents the model comparison results for

constrained and unconstrained models. We selected models which were as parsimonious as possible within the range of the reference values. With respect to the CLPM, the values for the model 4 was selected. In the RI-CLPM, the model 3 had chosen based on comparison with the model 1.

Direction of Associations at the Between-Person Level

Stability paths, initial correlations, and correlated changes are reported in Tables 2, 3, and 4. As presented in Figure 1, a positive cross-lagged path was found from neuroticism to reconsideration of commitment ($\beta = .11; p = .022$). A negative cross-lagged path was found from agreeableness to in-depth exploration ($\beta = -.10; p = .011$). Two positive cross-lagged paths were found from conscientiousness to commitment ($\beta = .09; p = .026$) and in-depth exploration ($\beta = .10; p = .012$). A positive cross-lagged path was found from reconsideration of commitment to neuroticism ($\beta = .09; p = .014$), and a negative cross-lagged path was found from reconsideration of commitment to conscientiousness ($\beta = .09; p = .005$).

Direction of Associations at the Within-Person Level

Stability paths, initial correlations, and correlated changes are reported in Tables 2, 3, and 4. The cross-lagged paths presented in Figure 2 show that when early adolescents had a higher level of agreeableness in the prior year, they reported increased commitment ($\beta = .14; p = .040$) one year later. Similarly, when early adolescents had a higher level of commitment in the prior year, they reported increased agreeableness ($\beta = .16; p = .015$) one year later.

Discussion

Adolescence is a period of development in which personality traits and identity processes are interwoven. The present study examined the direction of associations between personality traits and educational identity processes on the between- and within- person levels in early adolescence. While this study generally showed that personality traits predict educational identity process, identity process also predict personality traits in each level. These findings

suggest that personality traits and identity processes are interrelated. Furthermore, our findings generally indicated similarities and differences in the direction of associations between personality traits and educational identity processes across between- and within-person levels, as detailed below.

Direction of Associations at the Between-Person Level

As expected, at the between-person level, personality traits generally predicted the identity process. Neuroticism positively predicted reconsideration of commitment (Hypothesis 1), suggesting that greater sensitivity to anxiety and depression traits might be associated with higher educational value, and greater reconsideration of goals. Conscientiousness, but not agreeableness, positively predicted commitment and in-depth exploration. These results partially supported Hypothesis 3 and 5, suggesting that higher intentionality toward goal achievement was associated with higher engagement with educational values and attitudes toward deepening them. Commitment represents a clear sense of self (i.e., identity synthesis), and reconsideration of commitment represents an aspect of identity crisis (Crocetti, 2017). Therefore, our findings suggest that the strength of the neuroticism and conscientiousness traits may highly predict the levels of healthy or unhealthy identity processes one year later.

Surprisingly, extraversion did not predict reconsideration of commitment (Hypothesis 2). Furthermore, contrary to the expected direction (Hypothesis 4), reconsideration of commitment was predicted positively by neuroticism and negatively by conscientiousness. These findings suggest that negative aspects of reconsideration of commitment and personality traits may be strongly interrelated. Neuroticism is unhealthy personality traits that predict psychosocial problems (e.g., Bliedorn et al., 2020). Reconsideration of commitment has both a positive aspect of seeking a new environment and a negative aspect of disappointment with the current situation. Specifically, the negative aspect (i.e.,

disappointment with current education) of reconsidering commitment was particularly strong among Japanese junior high school students, as it is very difficult for them to change the educational track they are receiving. The intensity of this disappointment with current education may be expressed in higher neuroticism and a lower awareness of the need to achieve their goals (i.e., conscientiousness). Our results suggest that these unhealthy side of self-formation may develop in an interrelated manner.

Unexpectedly, agreeableness negatively predicted in-depth exploration. Agreeableness represents the characteristic of cooperating with others and adjusting one's behavior to situations (Caspi et al., 2005). In contrast, in-depth exploration is the process of gathering information and talking with others about current educational commitments. Such a process may require one's own intentions rather than cooperation with others in some situations. Our finding suggests that cooperative personality traits may inhibit attitudes that seek to deepen current commitments.

Direction of Associations at the Within-Person Level

For associations at the within-person level, one finding was as per expectation (Hypothesis 8): commitment positively predicted agreeableness. This result suggests that adolescents tend to change their thoughts, feelings, and behaviors in a collaborative manner by gaining a sense of commitment from their education. Educational commitment is thought to include following the school rules, adapting to schoolwork, and getting along with friends. Especially in the Japanese education system, it is common for students to take classes in groups of 40 per class, which requires them to work well with teachers and friends. Therefore, our finding may represent the process by which educational goals reflecting cooperation with others are internalized into the personality traits of early adolescents.

Meanwhile, agreeableness positively predicted commitment. This finding suggests that the willingness to be cooperative with friends and teachers may enhance commitment to

educational goals and values. This result supports the position that stable components of the self (i.e., personality traits) are expected to affect less stable components (i.e., educational identity processes) (Kandler et al., 2014). By showing that agreeableness and commitment interact with each other, this study suggests that the process by which individuals internalize educational goals into their own traits may occur simultaneously with an increase in the trait of cooperative behavior toward those goals during early adolescence in Japan.

Surprisingly, no association was found between personality traits and identity processes, except for a bi-directional relationship between agreeableness and commitment. This result suggests that individual differences in personality change may not be significant in early adolescents in Japan. This may reflect the Japanese educational context in which education is more uniform toward the group than toward the individual. For example, opportunities to actively communicate one's opinions (e.g., assertion training) are not part of the educational curriculum in Japan. In addition, although teaching styles have been changing in recent years with the introduction of active learning (Bonwell & Eison, 1991), teachers still spend a lot of time talking in class. Considering that the association between personality traits and identity at within-person level was not as significant as that at between-person level, it is possible that in the Japanese educational context, the emphasis is on uniform and collective enhancement of students' personality traits rather than on developing them according to individual traits.

Which Comes First, Personality Traits or Educational Identity Process? Developmental Implication

Our results have some implications for self-development. They show that personality traits could largely predict educational identity processes. These findings support the idea that the core elements of the self predict adaptation to the environment (Kandler et al., 2014). In addition, our findings show that the educational identity process predicted personality traits at

both levels, i.e., within- as well as between-persons. These findings support the hypothesis that the self-formation process proceeds by internalizing the perspectives of others (Crone & Fuligni, 2020). Specifically, at the between-person level, high reconsideration of commitment could result in (mal)adaptive personality traits one year later, thus suggesting that supporting reconsideration of commitment in education can promote adolescents' healthy self-development. At the within-person level, commitment predicted agreeableness, suggesting that fostering educational commitment among adolescents may contribute toward increasing cooperative traits.

Overall, our findings suggest that the direction of the association between personality and identity processes varies based on level (i.e., between-person or within-person) and dimension (i.e., traits and process). Researchers must consider these differences and accumulate evidence on self-development.

Limitations and Suggestions for Future Research

This study is not without limitations. First, it did not examine the relationship between openness and educational identity processes. In the future, another scale should be used to examine the relationship between the two. Second, personality traits and educational identity process were assessed using self-reports. To provide stronger evidence, future research should include other types of report measures to corroborate the current findings. Third, the attrition rate of participants in the present longitudinal study was high. This may be because of the minimal compensation (i.e., 50 JPY that correspond to 0.5\$) the participants received, although this value is considered the norm for research participation in Japan. In future research, it is important to formulate a plan for incentivizing retention in longitudinal studies. Fourth, reproducibility needs to be considered. The direction of associations between personality traits and educational identity process were not strong overall. Furthermore, it is not clear whether the results reflect the Japanese culture or whether they are also seen in

other countries since this study only used a Japanese sample. In the future, it is necessary to examine whether similar results can be obtained in other countries.

Conclusions

This study revealed the development of the adolescent self through the direction of associations between personality traits and educational identity processes. This study expanded existing knowledge about the development of the adolescent self through revealing the direction of associations between personality traits and educational identity processes. Our results show that personality traits generally predict educational identity process in early adolescence. Furthermore, we found that educational identity predicted personality traits at both the between- and within-person levels. Specifically, we found that commitment and reconsideration of commitment predicted healthy and unhealthy traits (conscientiousness and neuroticism). We expect that our findings will be applied in future research for the development of theory, intervention programs, and methods related to personality and identity development in early adolescence.

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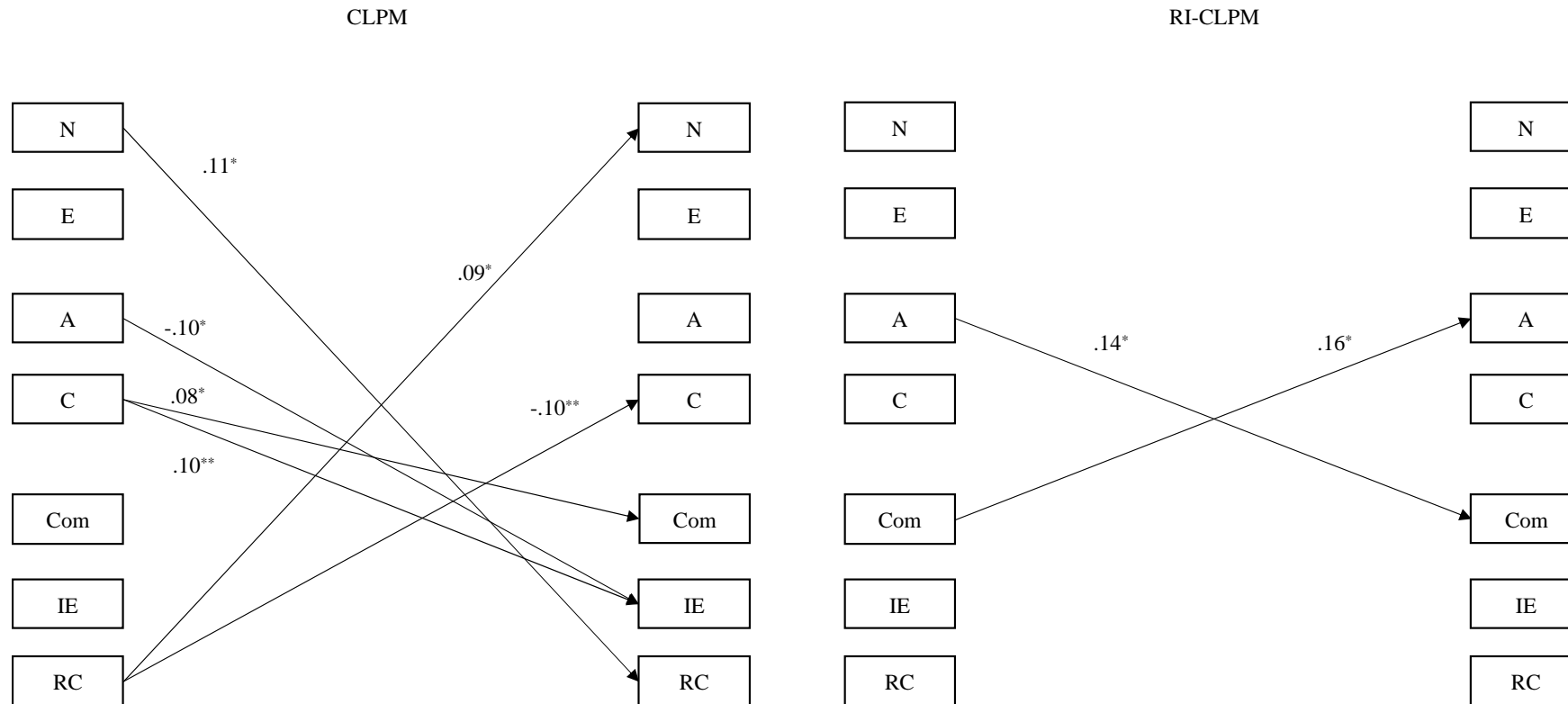


Figure 1 Final CLPM (left) and RI-CLPM (right). Within-time correlations and stability paths are not presented for reasons of clarity. Only significant cross-lagged paths linking Big Five traits to educational identity processes are shown. Given that the constrained model was retained, we present only two waves, and all coefficients displayed represent the averaged standardized path coefficients over the fourth time intervals. N = neuroticism; E = extraversion; A = agreeableness; C = conscientiousness; Com =commitment; IE = in-depth exploration; RC = reconsideration of commitment. $*p < .05$, $**p < .01$

Table 1

Descriptive Statistics and Rank-Order Stability

Variable	13 years (N = 618)			14years (N = 438)			15years (N = 357)			16years (N = 212)		
	<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α	<i>M</i>	<i>SD</i>	α
Personality traits												
Neuroticism	3.06	0.52	0.86	3.00	0.47	0.79	2.99	0.47	0.82	2.94	0.44	0.80
Extraversion	3.08	0.49	0.82	3.07	0.47	0.82	3.05	0.48	0.83	3.08	0.41	0.77
Openness	2.96	0.33	0.50	2.99	0.29	0.40	3.01	0.31	0.51	3.00	0.28	0.50
Agreeableness	3.22	0.37	0.68	3.20	0.36	0.68	3.22	0.37	0.69	3.17	0.35	0.71
Conscientiousness	2.95	0.46	0.80	3.02	0.43	0.79	3.05	0.42	0.80	2.99	0.39	0.75
Educational identity process												
Commitment	3.07	0.69	0.88	3.20	0.67	0.91	3.26	0.69	0.89	3.18	0.67	0.90
In-depth exploration	2.87	0.73	0.87	2.95	0.68	0.87	3.06	0.71	0.87	3.01	0.66	0.88
Reconsideration of commitment	2.67	0.77	0.86	2.77	0.71	0.86	2.81	0.72	0.84	2.85	0.67	0.81

Note. *M* = mean, *SD* = standard deviation, α = Cronbach's alpha coefficient

*** $p < .001$

Table 2

Stability paths for the cross-lagged panel analysis and random intercept cross-lagged panel analysis

	Stability paths	
	CLPM	RI-CLPM
Neuroticism	.58 ^{***}	.16
Extraversion	.70 ^{***}	.24 ^{**}
Agreeableness	.55 ^{***}	.05
Conscientiousness	.56 ^{***}	.10
Commitment	.33 ^{***}	.02
In-depth exploration	.30 ^{***}	.09
Reconsideration of comitment	.26 ^{***}	.01

** $p < .01$, *** $p < .001$

Table 3

Initial Correlations for the cross-lagged panel analysis (above) and random intercept cross-lagged panel analysis (below)

	1	2	3	4	5	6	7	8
1. Neuroticism	—	-.44***	.13*	-.31***	-.26***	-.04	-.01	.13**
2. Extraversion	-.40***	—	-.13*	.27***	.19***	.19***	.19***	.05
3. Openness	.06	-.09	—	-.14**	.06	.10*	.12*	.14**
4. Agreeableness	-.18*	.23**	-.11	—	.18**	.08	.04	-.24***
5. Conscientiousness	.04	.14	.07	.10	—	.41***	.44***	.24***
6. Commitment	.14	.14	.09	.07	.46***	—	.67***	.37***
7. In-depth exploration	.14*	.12	.08	.12	.51***	.65***	—	.59***
8. Reconsideration of commitment	.13	.03	.08	-.12	.34***	.38***	.59***	—

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 4

Correlated change for the cross-lagged panel analysis (above) and random intercept cross-lagged panel analysis at Time 2 (below)

	1	2	3	4	5	6	7
1. Neuroticism	—	-.22***	-.28***	-.13*	-.06	-.04	.09*
2. Extraversion	-.16	—	.14**	.20***	.22***	.24***	.14**
3. Agreeableness	-.45***	.21*	—	.17**	.08	.02	-.13**
4. Conscientiousness	.05	.13	.23*	—	.22***	.20***	.04
5. Commitment	-.01	.24**	.24**	.24*	—	.65***	.31***
6. In-depth exploration	.02	.31***	.15	.23**	.65***	—	.56***
7. Reconsideration of commitment	.20*	.25**	-.09	.12	.35***	.63***	—

* $p < .05$, ** $p < .01$, *** $p < .001$

Table 5

Correlated change for the intercept cross-lagged panel analysis at Time 3 (above) and 4 (below)

	1	2	3	4	5	6	7
1. Neuroticism	—	-.32**	-.30**	-.14	-.05	-.02	.02
2. Extraversion	-.20	—	.13	.27**	.23**	.15	.05
3. Agreeableness	-.30**	.17	—	.21*	.20**	.14	-.06
4. Conscientiousness	.08	-.09	.09	—	.14	.19*	-.02
5. Commitment	-.23*	.16	.17	.48***	—	.60***	.28**
6. In-depth exploration	-.01	.11	.07	.48***	.68***	—	.56***
7. Reconsideration of commitment	.12	.26*	.13	.32**	.34***	.57***	—

* $p < .05$, ** $p < .01$, *** $p < .001$

Supplemental information on missing values.

The chi-square tests were conducted to examine differences by sex, residential areas, and household income. The distribution did not differ according to sex [$2(1, N = 618) = 0.629, p = 0.730$ Cramer's $V = .032$], residential areas [$2(7, N = 618) = 2.219, p = 0.947$ Cramer's $V = .060$], or household income [$2(9, N = 618) = 5.822, p = 0.758$ Cramer's $V = .100$].

Supplemental information on mean scores.

If the distribution of scores is not normal and tends toward extremes (ceiling or floor effects), this could have an important impact on correlation. Table S1 indicates that no ceiling or floor effects were found with respect to the means of all variables. In addition, a MANOVA was conducted to examine whether there were differences in personality traits and identity process scores by sex (Table S2). Girls scored higher than boys on Time 2 conscientiousness, but the effect size values were small (Cohen, 1988). Hence, further analyses were conducted without taking sex differences into account.

Table S1

Descriptive Statistics for all Variables

Variable	13 years (N = 618)				14years (N = 438)				15years (N = 357)				16years (N = 212)			
	<i>M</i>	<i>SD</i>	<i>M-SD</i>	<i>M+SD</i>	<i>M</i>	<i>SD</i>	<i>M-SD</i>	<i>M+SD</i>	<i>M</i>	<i>SD</i>	<i>M-SD</i>	<i>M+SD</i>	<i>M</i>	<i>SD</i>	<i>M-SD</i>	<i>M+SD</i>
Personality traits																
Neuroticism	3.06	0.52	2.54	3.58	3.00	0.47	2.53	3.47	2.99	0.47	2.51	3.46	2.94	0.44	2.49	3.38
Extraversion	3.08	0.49	2.58	3.57	3.07	0.47	2.60	3.54	3.05	0.48	2.57	3.53	3.08	0.41	2.67	3.49
Openness	2.96	0.33	2.63	3.30	2.99	0.29	2.70	3.28	3.01	0.31	2.70	3.32	3.00	0.28	2.71	3.28
Agreeableness	3.22	0.37	2.85	3.59	3.20	0.36	2.84	3.56	3.22	0.37	2.85	3.59	3.17	0.35	2.82	3.52
Conscientiousness	2.95	0.46	2.49	3.41	3.02	0.43	2.59	3.45	3.05	0.42	2.63	3.47	2.99	0.39	2.60	3.37
Educational identity process																
Commitment	3.07	0.69	2.38	3.76	3.20	0.67	2.53	3.87	3.26	0.69	2.57	3.94	3.18	0.67	2.51	3.85
In-depth exploration	2.87	0.73	2.14	3.60	2.95	0.68	2.26	3.63	3.06	0.71	2.35	3.76	3.01	0.66	2.35	3.67
Reconsideration of commitment	2.67	0.77	1.90	3.44	2.77	0.71	2.06	3.48	2.81	0.72	2.09	3.52	2.85	0.67	2.18	3.53

Table S2
Sex Differences in Personality Traits and Identity Processes

Variable	Time 1							Time 2						Time 3						Time 4								
	Boys (N =300)		Girls (N = 317)		F-value	p	η^2	Boys (N = 203)		Girls (N = 235)		F-value	p	η^2	Boys (N = 168)		Girls (N = 189)		F-value	p	η^2	Boys (N = 105)		Girls (N = 107)		F-value	p	η^2
	M	SD	M	SD				M	SD	M	SD				M	SD	M	SD				M	SD	M	SD			
Personality traits																												
Neuroticism	3.07	0.50	3.05	0.54	0.88	0.42	0.00	2.94	0.47	3.05	0.46	6.53	0.01	0.02	2.94	0.46	3.03	0.49	3.39	0.07	0.01	2.90	0.43	2.97	0.46	1.11	0.29	0.01
Extraversion	3.09	0.47	3.07	0.52	0.24	0.79	0.00	3.06	0.46	3.08	0.48	0.06	0.80	0.00	3.05	0.44	3.04	0.52	0.05	0.83	0.00	3.09	0.35	3.08	0.46	0.02	0.89	0.00
Openness	2.97	0.33	2.96	0.34	0.29	0.75	0.00	2.97	0.27	3.00	0.31	1.19	0.28	0.00	3.00	0.33	3.02	0.29	0.50	0.48	0.00	3.01	0.25	2.99	0.32	0.39	0.53	0.00
Agreeableness	3.19	0.37	3.24	0.36	2.24	0.11	0.01	3.20	0.38	3.20	0.34	0.00	0.95	0.00	3.19	0.35	3.25	0.38	2.38	0.12	0.01	3.13	0.37	3.20	0.33	2.04	0.16	0.01
Conscientiousness	2.94	0.47	2.96	0.45	0.57	0.56	0.00	2.97	0.46	3.06	0.40	5.37	0.02	0.01	3.03	0.39	3.07	0.44	0.80	0.37	0.00	2.99	0.39	2.98	0.39	0.07	0.79	0.00
Educational identity process																												
Commitment	3.08	0.68	3.07	0.70	0.03	0.97	0.00	3.23	0.71	3.17	0.63	1.14	0.29	0.00	3.25	0.71	3.26	0.67	0.03	0.86	0.00	3.21	0.65	3.15	0.68	0.46	0.50	0.00
In-depth exploration	2.90	0.75	2.84	0.71	1.19	0.31	0.00	3.00	0.72	2.91	0.65	1.84	0.18	0.00	3.10	0.72	3.02	0.70	0.98	0.32	0.00	3.04	0.68	2.97	0.64	0.60	0.44	0.00
Reconsideration of commitment	2.69	0.78	2.66	0.76	1.62	0.20	0.01	2.76	0.74	2.78	0.69	0.15	0.70	0.00	2.89	0.72	2.74	0.71	3.83	0.05	0.01	2.86	0.74	2.85	0.61	0.02	0.89	0.00

Table S3

Fit Indices of the Personality Traits and Educational Identity Process Measurement Model

	S-B χ^2	Δ S-B χ^2	Δdf	p	CFI	\DeltaCFI	RMSEA [90% CI]	\DeltaRMSEA	SRMR	\DeltaSRMR	AIC	\DeltaAIC
Personality traits												
Neuroticism												
Configural	54.113				.958		.036 [.020-.051]		.052		4828.041	
Metric	61.398	7.4536	6	0.281	.956	.002	.034 [.018-.048]	.002	.067	.015	4825.390	2.651
Extraversion												
Configural	67.578				.933		.045 [.031-.059]		.064		5141.427	
Metric	71.219	6.7033	6	0.349	.937	.004	.040 [.026-.053]	.005	.069	.005	5140.907	.520
Openness												
Configural	64.825				.898		.043 [.029-.058]		.058		4776.709	
Metric	48.217	1.5679	6	0.956	.964	.066	.023 [.000-.039]	.020	.070	.012	4769.812	6.897
Agreeableness												
Configural	118.309				.944		.031 [.020-.041]		.060		7267.700	
Metric	116.365	3.7581	9	0.921	.958	.014	.026 [.013-.036]	.005	.068	.008	7257.426	10.274
Conscientiousness												
Configural	43.288				.983		.027 [.000-.043]		.041		4719.525	
Metric	52.088	8.7932	9	0.186	.979	.004	.027 [.006-.042]	.000	.060	.019	4719.541	.016
Educational identity pprocess												
Commitment												
Configural	257.517				.965		.039 [.031-.046]		.047		14663.862	
Metric	275.917	17.85	12	0.120	.963	.002	.038 [.031-.045]	.001	.061	.014	14661.000	2.862
In-depth exploration												
Configural	279.036				.955		.042 [.035-.049]		.051		16303.936	
Metric	287.827	7.75	12	0.804	.956	.001	.040 [.033-.046]	.002	.055	.004	16289.601	14.335
Reconsideration of commitment												
Configural	42.330				.991		.026 [.000-.043]		.041		9801.186	
Metric	44.582	2.635	6	0.853	.994	.003	.020 [.000-.037]	.006	.042	.001	9792.838	8.348

Note: S-B χ^2 = Satorra–Bentler adjusted χ^2 test statistic; Δ S-B χ^2 = change in S-B χ^2 . p = p value across model comparisons, based on S-B χ^2 difference; testing (Δ S-B χ^2); CFI = comparative fit index, RMSEA = root mean-square error of approximation and 90% confidence interval, SRMR = standardized root mean-square residual; AIC = akaike information criteria; Δ = change in parameter

Table S4

The model fit of CLPM and RICLPM

Model	Model fits					Model comparisons							
	S-B χ^2	CFI	RMSEA [90% CI]	SRMR	AIC	Pairs	Δ S-B χ^2	Δdf	p	Δ CFI	Δ RMSEA	Δ SRMR	Δ AIC
CLPM													
M1: Baseline model	531.511	.877	.065 [.059-.071]	.068	13496.7								
M2: Model with stability paths fixed to be time-invariant	537.293	.880	.061 [.056-.067]	.082	13485.93	M2-M1	13.205	14	.510	.003	-.004	.015	-10.767
M3: Model with stability and cross-lagged paths fixed to be time-invariant	613.724	.882	.049 [.044-.054]	.085	13442.75	M3-M1	11.120	98	.190	.005	-.016	.017	-53.952
M4: Model with stability and cross-lagged paths and T2-T4 within-time correlations fixed to be time-invariant	622.093	.886	.047 [.042-.051]	.085	13431.03	M4-M1	128.546	119	.259	.009	-.018	.017	-65.665
RI-CLPM													
M1: Baseline model	188.189	.982	.031 [.022-.039]	.052	13183.788								
M2: Model with stability paths fixed to be time-invariant	199.736	.983	.028 [.020-.036]	.062	13176.599	M2-M1	14.178	14	.437	.001	-.003	.010	-7.189
M3: Model with stability and cross-lagged paths fixed to be time-invariant	311.262	.976	.027 [.020-.033]	.069	13147.39	M3-M1	125.189	93	.014	-.006	-.004	.017	-36.403
M4: Model with stability and cross-lagged paths and T2-T4 within-time correlations fixed to be time-invariant	370.059	.972	.026 [.020-.032]	.061	13149.19	M4-M1	185.473	140	.006	-.010	-.005	.009	-35.599

Note: S-B χ^2 = Satorra–Bentler adjusted χ^2 test statistic; Δ S-B χ^2 = change in S-B χ^2 . p = p value across model comparisons, based on S-B χ^2 difference; testing (Δ S-B χ^2); CFI = comparative fit index, RMSEA = root mean-square error of approximation and 90% confidence interval, SRMR = standardized root mean-square residual; AIC = akaike information criteria; Δ = change in parameter