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Daily Dynamics of Adolescent Mood and Identity

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Important linkages between daily mood and identity formation have been theorized, but have not been empirically tested as of yet. This study provided a first examination of these linkages within individuals (N = 392; 55.1% boys; M_{age} at T1 = 13.24, SD = 0.44) across 15 series of 5 days distributed over 5 years. Results revealed negative within-time associations of educational and relational commitment with negative mood. Negative mood was positively associated with educational in-depth exploration and educational and interpersonal reconsideration. Additionally, there were some cross-lagged effects suggesting that identity and mood mutually affect one another across days. These results contribute to the growing knowledge on how identity unfolds in everyday life by revealing important associations with daily mood.

Although adolescence is no longer considered as a period of "storm and stress" (Hall, 1904), it is characterized by considerable mood variability. Such mood variability does not affect all adolescents, but is more prevalent in adolescence than in any other period in the life span (Arnett, 1999). Adolescence is also the period in which individuals need to establish an identity. As identity formation has been described as a potentially stressful developmental task in itself, it is thought to affect mood (Erikson, 1950). Conversely, identity change is also thought to be triggered by emotions (Kunnen, Bosma, Van Halen, & Van der Meulen, 2001). Hence, there are good reasons to expect that adolescent identity formation and mood variability are associated with one another. Yet, linkages between daily identity formation and daily mood have not been examined until now. This study provided a first examination of these linkages.

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Adolescent Mood Variability

When compared to other stages in the life span, mood in adolescence is more often negative and generally less stable. That is, depressive symptoms peak in adolescence (e.g., Hankin et al., 1998; Wickrama, Conger, Lorenz, & Jung, 2008), and mood fluctuations (i.e., changes in mood valence in a particular person from one moment to the next) are particularly common. With diary data in which mood was tracked from day to day or even from moment to moment, it has been found that such fluctuations were indeed greater among adolescents than among their parents (Larson & Richards, 1994). In a longitudinal study (Larson, Moneta, Richards, & Wilson, 2002), mood fluctuations were also found to decrease as adolescents grew older, suggesting that especially the period from early to mid-adolescence is characterized by relatively large mood fluctuations.

Adolescent mood fluctuations are thought to be caused by the accumulative effect of the many physical, psychological, and psychosocial changes adolescents face (Larson & Richards, 1994). In dealing with all these changes, adolescents can no longer rely on their parents' teachings but need to

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establish their own set of goals, ideals, and commitments. In other words, they need to establish a personal identity (Erikson, 1950). Emotions and identity have been directly linked to one another, as it has been claimed that identity is "rooted in emotion" (Kunnen et al., 2001). Thus, experiencing negative emotions may spark a renewed identity search (i.e., increased exploration), and positive emotions may lead individuals to increasingly identify with their current identity-relevant choices. Conversely, Erikson (1950) claimed that identity formation can be stressful and might therefore lead to changes in mood. As such, it is plausible to expect that adolescent mood and identity formation mutually affect one another across time.

Adolescent Identity Formation

Contemporary research on identity formation employs models that expand upon Marcia's (1966) original distinction between dimensions of commitment (i.e., feeling certain about current choices and engaging in relevant activities toward the implementation of these choices) and exploration (i.e., examining and comparing several possible alternative choices). Researchers agree especially on the need to divide Marcia's broad exploration dimension into more specific dimensions (e.g., Crocetti, Rubini, & Meeus, 2008; Luyckx et al., 2008). In the present study, we used a three-part model of identity formation that distinguishes among dimensions of commitment, reconsideration, and in-depth exploration (Crocetti, Rubini, & Meeus, 2008). Commitment is operationalized in a similar way as in Marcia's (1966) model. The first of the two exploration dimensions, reconsideration, refers to the extent to which individuals doubt their current commitments and consider alternatives. The second exploration dimension, in-depth exploration, captures the extent to which current commitments are reflected upon, discussed with relevant others, and evaluated in terms of their usefulness. The dimensions of this model are clearly empirically separable (Crocetti, Rubini, & Meeus, 2008), are differentially associated with, for example, personality traits and parenting dimensions (e.g., Morsünbül, Crocetti, Cok, & Meeus, 2014), and show differential developmental patterns from early to late adolescence (Klimstra, Hale, Raaijmakers, Branje, & Meeus, 2010). Furthermore, the original identity statuses defined by Marcia (1966) (i.e., categories based on particular patterns of scores on identity dimensions) can be replicated with this three-dimension model, while a theoretically compelling additional status category also emerges (e.g., Crocetti, Schwartz, Fermani, Klimstra, & Meeus, 2012). Thus, there is a rapidly increasing literature on the three-dimension model of identity.

Identity dimensions can apply to both ideological (i.e., occupation, religion, and politics) and interpersonal domains (i.e., friendships, dating, and sex roles) (Grotevant, Thorbecke, & Meyer, 1982). Studying different identity domains separately is useful because adolescents with a strong sense of identity in one domain do not necessarily have a strong sense of identity in other domains (Goossens, 2001). Previous studies with the aforementioned three-part model (Crocetti, Rubini, & Meeus, 2008) mainly examined two specific domains that are of central importance to adolescents: relationship with the best friend and education. Thus, in addition to the multidimensional nature of identity formation, it is also important to distinguishing specific domains.

Adolescent Identity Formation and Mood Variability: Toward Short-Term Approaches

Research on identity formation is flourishing due to the adoption of multidimensional models (Meeus, 2011) in the assessment of different identity domains (e.g., Klimstra et al., 2013). Yet, the dynamic nature of identity processes is not well-captured in most previous studies, because these studies typically examined identity formation either cross-sectionally or with relatively long intervals between measurement occasions (e.g., 3 months or more). However, identity formation is considered a continuous process that takes place on a day-to-day level (Klimstra, Luyckx et al., 2010). Furthermore, daily measurements have several important benefits over long-term measurements (Bolger, Davis, & Rafaeli, 2003). First, they are less affected by retrospection biases due to much briefer periods between the event and the participants reporting on the event. Specifically, individuals are asked to report on 1 day at a time instead of on a period of a week or even more. Second, phenomena such as state-congruent recall (e.g., responses to depression measures being affected by one's current mood; Bower, 1981) and the peak-end rule (e.g., reports on one's emotional state during a week being disproportionately affected by the worst day of that week; Stone, Broderick, Kaell, DelesPaul, & Porter, 2000) cause frequent measurements to be more reliable than long-term measurements, as the former are less affected by these phenomena.

So far, two studies have examined short-term processes regarding dimensions of the previously mentioned three-dimension model of identity. These studies provided promising findings that point to the potential of short-term approaches in advancing research on identity formation. Specifically, Klimstra, Luyckx et al. (2010) found that commitment and reconsideration negatively predicted one another on a day-to-day level. Commitment is thought to reflect a sense of certainty (i.e., a stable sense of identity), and reconsideration is thought to reflect a sense of uncertainty (i.e., role confusion). Therefore, these findings were in line with Erikson's (1950) theoretical idea that adolescents oscillate between a sense of identity (i.e., commitment) and role confusion (i.e., reconsideration). A second key finding of Klimstra, Luyckx et al. (2010) was that experiencing consistent levels of reconsideration across days was related to a stronger sense of identity. This finding is in line with Erikson's (1950) initial claim that a stable identity entails a sense of sameness and continuity. Schwartz et al. (2011) expanded on these findings by showing that a stable sense of identity (i.e., consistent levels of reconsideration) also predicted decreased levels of depressive and anxiety symptoms.

The aforementioned studies (Klimstra, Luyckx et al., 2010; Schwartz et al., 2011) used portions of the same data that were also employed in this study. However, at the time those studies were conducted only 15 days of diary data covering 1 year in early adolescence were available, whereas this study employs 75 days of diary data covering 5 years (i.e., early to late adolescence). In addition, these publications did not focus on the role of daily mood in identity. Moreover, despite their importance, both these studies do not benefit from what is perhaps the biggest advantage of frequent measurements: The possibility to study associations between identity and other phenomena at the within-person level.

Typically, between-person associations are studied. In those associations, individual differences in identity dimensions may, for example, be related to individual differences in general tendencies to experience certain moods (e.g., mood disorder symptoms). In such studies, one may find that individuals with higher levels of commitment have relatively lower levels of depressive symptoms. Although tempting, it is wrong to conclude in such instances that particular individuals will be less depressed or sad at times that they are more committed. This is because between-person associations are population-based estimates that are uninformative with respect to associations between variables within particular individuals (Molenaar & Campbell, 2009). To uncover whether individuals are truly less sad on days that they are more committed, it is necessary to examine within-person associations.

Moreover, developmental changes can only be truly tracked at the between-person level if these unfold in a similar way for every single individual in a sample. Identity formation is thought to be partly rooted in emotions (e.g., Kunnen et al., 2001), and it is therefore likely to be highly idiosyncratic. It may be largely determined by the events that one (accidentally) encounters and by particular emotions that arise. Within-person approaches are much better in capturing this idiosyncrasy and are ideal for determining, for example, whether emotions predict changes in identity or whether it is the other way around (Lichtwarck-Aschoff, van Geert, Bosma, & Kunnen, 2008). Thereby, such approaches come much closer than between-person approaches (e.g., normal correlations, regressions) to uncovering causality between processes from time-series data (e.g., Gottman, 1990; Granger, 1969).

Concepts related to personal identity have been associated with mood-related constructs at the within-person level. For example, individuals have been shown to reflect greater well-being and a more positive mood at times that their ethnic identity was stronger (i.e., more salient) (e.g., Yip, 2005; Yip & Fuligni, 2002). Likewise, purpose in life, which is conceptually linked to personal identity commitment, has been shown to be associated with mood at the daily level (e.g., Kiang, 2012). Unfortunately, studies directly examining within-person associations between personal identity dimensions and mood are nonexistent.

In previous studies examining such processes at the between-person level, strong commitments were consistently found to be negatively associated with emotional disorder symptoms (i.e., depression and anxiety symptoms; Meeus, 2011; Meeus, Iedema, Helsen, & Vollebergh, 1999). Reconsideration was consistently positively associated with emotional disorder symptoms (Crocetti, Rubini, & Meeus, 2008; Meeus, 2011), whereas linkages between in-depth exploration and such symptoms have not been consistently demonstrated (Crocetti, Klimstra, Keijsers, Hale, & Meeus, 2009; Crocetti, Rubini, & Meeus, 2008; Luyckx, Goossens, Soenens, & Beyers, 2006; Luyckx et al., 2008).

Only one study has examined identity domains separately in relation to mood disorder symptoms,

suggesting that these symptoms were more strongly related to educational identity dimensions than to identity dimensions in the interpersonal domain (i.e., best friend and intimate partner; Meeus, Iedema, Maassen, & Engels, 2005). These differences may be caused by the different nature that these domains have in the Netherlands (i.e., the country where the study by Meeus et al., 2005, and this study were conducted) when compared to, for example, the United States. In the Netherlands, there are different levels of high school. These are vocational education, higher professional education, and university preparatory education. Within these levels, students choose a specific curriculum (i.e., culture and society, economy and society, nature and health, and nature and technology within the two highest levels of education) in their third year, when they are typically 14–15 years old. The level and curriculum one completes largely determine one's options for choosing majors in advanced education (e.g., college), unlike in, for example, the United States where individuals typically choose their major in the first year of college. As it is hard to change between levels or curricula, the direction of one's later career is to a considerable extent determined when adolescents are only 14–15 years old. Thus, educational identity starts early in the Netherlands (Klimstra, Luyckx, & Meeus, 2012), and it becomes a closed domain early on in adolescence, in which it may be hard to change an unsatisfying commitment (Meeus et al., 1999). Much like in other countries, in the Netherlands individuals can change their commitments relatively easily in relational domains referring to friendships. Hence, such domains should be considered open domains. As a result of their different nature, weak commitments or doubts about commitments may be less of a threat in open domains when compared to closed domains.

Overall, the aforementioned studies generally suggest that a weak sense of identity is related to mood disorder symptoms. However, it remains unclear how identity dimensions are associated with mood on a day-to-day level, at a within-person instead of at the between-person level, and whether such associations are different depending on the identity domain under consideration.

The direction of effects between identity dimensions and mood also remains largely unexamined. Specifically, we are aware of only one study that more or less addressed this issue by examining the direction of effects between identity and mood disorder symptoms (Schwartz, Klimstra, Luyckx, Hale, & Meeus, 2012). In that study, bidirectional negative effects between identity commitment and depressive symptoms, and a unidirectional positive effect of anxiety symptoms on identity reconsideration, were found. Despite the importance of the study by Schwartz et al. (2012), it is still characterized by the same limitations as the aforementioned cross-sectional studies on the linkages between identity and mood (i.e., no within-person associations, long intervals between measurement occasions, and identity domains not considered separately).

Finally, there are gender differences in mean levels of mood disorder symptoms (e.g., depressive symptoms) and mood fluctuations, with girls displaying higher levels when compared to boys (e.g., Maciejewski et al., 2014). In addition, girls tend to have more advanced and better-explored identities (e.g., Klimstra, Hale et al., 2010; Luyckx, Klimstra, Duriez, Van Petegem, & Beyers, 2013) when compared to boys. However, it is unclear whether there are gender differences in within-person associations between identity and mood. At the between-person level, no such differences have been found (Schwartz et al., 2012).

The Present Study

The purpose of this study was to examine the short-term dynamics between identity processes and mood at a within-person level. For this purpose, we focused on two specific domains: education and the relationship with the best friend. Based on previous studies examining between-person associations between identity dimensions and mood disorder symptoms, we first tentatively expected positive mood to be associated with high levels of identity commitment and low levels of reconsideration. Second, associations between in-depth exploration and mood were expected to be weak or nonexistent. Third, we expected stronger associations in the educational identity domain than in the friendship identity domain. Fourth, regarding the direction of effects, we expected bidirectional linkages to emerge with identity and mood mutually affecting one another over time. Fifth, we examined gender differences in the associations between identity and mood, but expected these to be nonexistent.

METHOD

Participants

Participants were enrolled in an ongoing longitudinal project called Research on Adolescent Develop-

ment And Relationships (RADAR). They were drawn from a large cohort of adolescents that was assessed before the actual study was initiated. Specifically, all sixth grade elementary school classes in the province of Utrecht, and in the cities of Amsterdam, Rotterdam, The Hague, and Almere (the Netherlands) were invited to participate in this pre-assessment (e.g., Schwartz et al., 2011). From the 850 primary education schools in this area, 429 schools were randomly selected. Of these schools, 296 agreed to participate, and data were collected at 230 of these 296 schools. Given the inclusion criteria for the larger RADAR project, all participating adolescents lived with both of their parents and had at least one sibling who was 10 years of age or older at the onset of the study. Of the families of the 1,544 adolescents who were randomly selected from the participating schools, 497 Dutch Caucasian adolescents met the inclusion criteria and agreed to participate in three Internet assessments each year in addition to annual home visits. Of these 497 adolescents, 392 (55.1% boys; 44.9% girls; M_{age} at the first Internet measurement = 13.24, SD = 0.44) who participated in more than 50% of the Internet assessments were included in the present analyses. These adolescents lived in over 50 different cities and villages in the Mid-Western part of the Netherlands and attended a wide range of different high schools. They were in the first grade of high school (i.e., equivalent to seventh grade in the United States) when the longitudinal study was initiated. Socioeconomic status (SES) was determined based on the profession of mothers and fathers. SES of the mother was low for 23.8%, medium for 35.0%, and high for 41.3% of the sample. For fathers, these figures were 13.5, 29.7, 56.8%, respectively.

The 105 adolescents that completed <50% of the Internet assessment, and hence were not included in the analyses, failed to complete more assessments due to noncompliance. These adolescents did not differ significantly from the 392 participating adolescents with regard to gender. Nonparticipating adolescents were somewhat older ($p < .001$; mean difference = 0.16 years), and their mother and father reported a somewhat lower socioeconomic status ($p < .001$, partial $\eta^2 = .03$ and $p < .01$, partial $\eta^2 = .02$, respectively).

Procedure

The pre-assessment among sixth graders in elementary school took place in 2005 and the longitudinal study began in 2006. Before the longitudinal study started, all adolescents and their parents received written information about the study and its purpose. Parents provided written informed consent for all participating family members (i.e., the target adolescent, the parents themselves, and a sibling). The medical ethical committee of the University Medical Centre Utrecht (the Netherlands) approved the study.

The longitudinal study consisted of both annual assessment and Internet assessments. In this study, only data from the Internet assessments were used. Participants completed end-of-day reports tapping into identity and mood for five consecutive days. The initial Internet assessment took place in June 2006, and the second and third Internet assessments took place 3 and 6 months later, respectively. This scheme was repeated in the following 4 years (i.e., 2007, 2008, 2009, and 2010). Hence, there were 15 Internet assessment weeks, yielding 75 days of diary data on mood and identity. Adolescents received 10 Euros (approximately 13USD) for each Internet assessment week they participated in.

Across all measurements of the participating adolescents (n = 392), 18.82% of data was missing. Consequently, the resulting data set consisted of 392 participants who provided reports on 26,591 days. A nonsignificant Little's (1988) missing completely a random test indicated that missingness was completely at random. Therefore, it is highly unlikely that our findings are biased due to missing values.

Measures

Identity formation. To measure identity on a daily basis, we used a single-item version of the Utrecht-Management of Identity Commitments Scale (U-MICS), a self-report measure designed by Meeus and colleagues (Crocetti, Rubini, Luyckx, & Meeus, 2008; Crocetti, Rubini, & Meeus, 2008). Similar to the full version of U-MICS, 5-point response scales ranging from 1 (*completely untrue*) to 5 (*completely true*) were used. The same items can be filled out to assess identity dimensions in different domains. In the current study, we focused on one ideological domain (i.e., education) and one interpersonal domain (i.e., relationship with the best friend) that play an important role in adolescents' daily lives.

Both the educational and relationship with the best friend domain were assessed with one item for each dimension (i.e., commitment, in-depth exploration, and reconsideration), totaling six items. Sample items for the educational domain

were as follows: "Today, I felt confident about myself because of my education" (commitment regarding education), "Today, I have been thinking a lot about my education" (in-depth exploration regarding education), and "Today, I felt that I could better look for different education" (reconsideration regarding education). For the best friend domain, almost the same items were used, but "education" was replaced by "best friend". Cronbach's alphas cannot be calculated for single-item scales, but a previous study (Klimstra, Luyckx et al., 2010) underscored the measure's reliability using Heise (1969) coefficients (i.e., an adjusted test–retest reliability measure). In that same study, convergent and discriminant validity was shown as the single-item measure correlated with the original version and outcome variables (i.e., academic adjustment for educational identity and relationship quality for friendship identity) in the expected way.

Mood. Daily mood was measured with the Daily Mood Scale, an Internet version of the Electronic Mood Device (Hoeksma et al., 2000). We focused on the scales for sadness (e.g., "Today I feel down"), anxiety (e.g., "Today I feel anxious"), and anger (e.g., "Today I feel angry"), which consisted of three items each. During daily Internet sessions, participants rated the intensity of sadness, anxiety, and anger on a 9-point scale from *not at all* to *very much*. Scale scores were calculated by summing. Reliability across measurements was satisfactory, as Cronbach's alphas ranged from .91 to .97 for sadness, from .72 to .92 for anxiety, and from .88 to .95 for anger.

Plan of Analysis

Preliminary analyses were conducted to attain descriptive statistics (means, standard deviations) and correlations among variables. Correlations among study variables were calculated at the daily level using the scores of individuals on the respective variables at the first (i.e., day 1) and last day of the diary study (i.e., day 75). In addition, we also calculated within-person variation scores. For this purpose, the most straightforward method is to calculate within-person standard deviations (e.g., Kernis, Grannemann, & Barclay, 1989; Klimstra, Luyckx et al., 2010). Therefore, we calculated within-person standard deviations across the 75 days of measurements included in this study to examine whether there was such variation.

Next, we ran a series of multilevel models to examine two types of within-person associations between identity and mood dimensions. All these analyses were based on multilevel (or random coefficient) regression modeling (e.g., Bryk & Raudenbush, 1992; Nezlek, 2001; Snijders & Bosker, 2012).

We first examined concurrent associations, which tell us how identity and mood are related within particular days. These associations, for example, indicate whether educational commitment is particularly high on days that an individual reports relatively low levels of sadness. Directionality of effects cannot be inferred from these associations. Specifically, for the concurrent associations, we estimated a series of three-level models with days nested in weeks nested in participants. At Level 1 in each of the models, one mood variable was predicted by one identity variable on that same day.

Second, we examined cross-lagged relations. Such cross-lagged analyses reveal, for instance, how identity on one day is associated with a *change* in mood from that day to the next (or vice versa) and is the closest one can come to inferring causal relations from time-series data (e.g., Gottman, 1990; Granger, 1969). Thus, these cross-lagged relations are informative regarding the directionality of effects. For this purpose, we estimated a series of three-level models. In each of these models, at Level 1, one of the mood variables was predicted by one of the identity variables measured on the previous day within that week. We controlled for the mood variable on the previous day. The same procedure was used in models examining the opposite relationship (identity on a given day predicted by mood and identity on the previous day).

In all models, intercept and slope values were allowed to vary across weeks (at Level 2 of the models) and across persons (at Level 3 of the models), hereby controlling for between-week and between-person variance. All Level 1 predictors were group-mean centered (Enders & Tofighi, 2007). In a final step, to examine possible gender differences, we reran all multilevel models including gender as a moderator variable (i.e., including interaction effects with gender) at Level 3 of each model.

RESULTS

Preliminary Analyses

Descriptive statistics are presented in Table 1. Because there are 75 measurement occasions in

TABLE 1
Descriptives Statistics and Correlations of Study Variables

	Descriptives		*Correlations*								
	M (range)	*SD (range)*	*1.*	*2.*	*3.*	*4.*	*5.*	*6.*	*7.*	*8.*	*9.*
1. Anger	6.45 (5.59–7.12)	4.72 (3.98–5.43)	–	.63***	.57***	−.15**	.03	.28***	−.15**	.06	.18**
2. Sadness	4.22 (3.71–5.96)	3.43 (2.94–5.21)	.77***	–	.73***	−.15**	.15**	.22***	−.04	.09	.21***
3. Anxiety	6.57 (5.47–7.36)	4.79 (3.97–5.45)	.73***	.81***	–	−.21***	.13*	.27***	−.08	.14*	.22***
4. EduCom	3.09 (2.87–3.36)	1.07 (0.97–1.27)	−.14*	−.16**	−.20**	–	.08	−.21***	.25***	.10	−.08
5. EduExp	2.89 (2.51–3.11)	1.14 (1.04–1.27)	−.04	−.10	.02	.44***	–	.02	.09	.21***	−.02
6. EduRec	1.72 (1.45–1.89)	0.95 (0.80–1.07)	.25***	.22***	.23***	−.03	.19**	–	−.07	.01	.17**
7. FriCom	2.91 (2.80–3.10)	1.09 (1.00–1.18)	−.06	−.02	−.10	.34***	.11	−.05	–	.45***	−.32***
8. FriExp	2.50 (2.36–2.71)	1.01 (0.90–1.10)	.08	.10	.03	.04	.21**	.02	.35***	–	−.11*
9. FriRec	1.73 (1.51–1.94)	1.00 (0.88–1.13)	.20**	.16*	.22***	−.01	.11	.35***	−.37***	−.20**	–

Note. EduCom = educational commitment; EduExp = education in-depth exploration; EduRec = educational reconsideration; FriCom = relational commitment; FriExp = relational in-depth exploration; FriRec = relational reconsideration. Above the diagonal are the bivariate correlations at the first day of the diary study, below the diagonal are the bivariate correlations at the last day of the diary study.
*$p < .05$; **$p < .01$; ***$p < .001$.

this study, we calculated the aggregated sample means and standard deviations, and respective ranges, of each of the mood and identity variables across the 75 days. Table 1 shows that sample means vary considerably over the course of the study.

Table 1 also displays correlations between the variables on the first (i.e., T1) and the last day (i.e., T75) of the 75-day diary study. There are strong positive correlations between the three mood variables on both the first (.57–.73) and the last day (.73–.81) in the diary study. However, the fact that these associations are considerable at the between-person level does not mean that they are also considerable at the within-person level for each particular individual (e.g., Vansteelandt, Van Mechelen, & Nezlek, 2005). For that reason, and because these mood variables are commonly thought to reflect separable constructs, we proceeded with measuring them separately.

Correlations among identity variables are weaker. Specifically, the three identity dimensions (commitment, in-depth exploration, and reconsideration) within each domain (educational identity and identity regarding the relationship with the best friend) are clearly separable from one another given their modest correlations at the daily level (i.e., |.08| – |.45|). In addition, the same dimensions (e.g., educational commitment with commitment regarding the best friend) were weak to moderately (.17–.35) correlated across domains.

A prerequisite for examining within-person associations of identity dimensions and mood is that there should be within-person variance in mood and identity dimensions. Sample means of within-person standard deviations representing such variation ranged from .73 for relational reconsideration to .94 for educational in-depth exploration. For mood, these figures were 3.32, 3.05, and 2.43 for anger, fear, and sadness, respectively. This indicates that mean within-person standard deviations were smaller than the between-person standard deviations for both identity and mood. Still, within-person variation in both identity and mood variables was substantial.

Within-Person Associations Between Identity and Mood

Concurrent associations. Table 2 gives an overview of the concurrent associations between the mood and identity variables as estimated from the multilevel models. Across the board, adolescents' mood was associated with most identity dimensions on a day-to-day level.

In line with the first hypothesis, educational commitment was negatively associated with anger, anxiety, and sadness, whereas reconsideration regarding both education and the best friend was positively associated with these emotions (Table 2). Commitment regarding the best friend was negatively associated with anger and sadness, but was not associated with anxiety.

Table 2 shows that our second hypothesis was also partly confirmed; in-depth exploration regarding the best friend was not associated with any of the mood variables on a day-to-day level. However, contrary to our expectations, educational

TABLE 2
Regression Coefficients (and Standard Errors) From Multilevel Analyses Describing Within-Person Concurrent Associations Between Each Mood Variable (Criterion) and Each Identity Variable (Predictor)

	Anger	*Anxiety*	*Sadness*
Educational commitment	−.466 (.046)***	−.402 (.044)***	−.323 (.035)***
Educational in-depth exploration	.129 (.034)***	.180 (.033)***	.063 (.024)**
Educational reconsideration	.527 (.060)***	.309 (.049)***	.231 (.042)***
Relational commitment	−.186 (.049)***	−.052 (.044)	−.076 (.036)*
Relational in-depth exploration	.016 (.030)	.040 (.039)	.016 (.030)
Relational reconsideration	.314 (.070)***	.169 (.059)**	.182 (.046)***

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

TABLE 3
Regression Coefficients (and Standard Errors) From Multilevel Analyses Describing Within-Person Cross-Lagged Relations in Which a Change in Each Mood Variable is Predicted by Identity Assessed the Previous Day

	Anger	*Anxiety*	*Sadness*
1. Educational commitment	−.027 (.040)	−.016 (.044)	−.031 (.031)
2. Educational in-depth exploration	.088 (.037)*	.071 (.031)*	.029 (.027)
3. Educational reconsideration	.059 (.060)	.050 (.055)	.010 (.045)
4. Relational commitment	.003 (.047)	.019 (.044)	.003 (.033)
5. Relational in-depth exploration	.043 (.051)	.102 (.040)*	.075 (.032)*
6. Relational reconsideration	.082 (.067)	.092 (.065)	.078 (.050)*

Note. All autocorrelation effects of mood was by mood on the previous day and were significant ($p < .001$), but these are not reported.
*$p < .05$.

in-depth exploration was positively associated with anger, anxiety, and sadness.

The overall pattern in Table 2 also confirmed our third hypothesis, as more associations were found in the educational versus best friend domain (nine significant coefficients vs. five, respectively). Thus, mood indeed seems to be most strongly associated with educational identity than with identity regarding the best friend.

Bidirectional relations. To test our fourth hypothesis, we first estimated models in which identity on one day predicted a change in mood from that day to the next. Results are displayed in Table 3. Educational commitment and reconsideration did not predict changes in mood, and educational in-depth exploration predicted increases in anxiety and anger, but not in sadness. Commitment regarding the best friend was not associated with changes in mood. In-depth exploration regarding the best friend predicted increases in anxiety and sadness, but not in anger. Finally, reconsideration regarding the best friend predicted increases in sadness, but not in anxiety and anger.

A second set of models was estimated to examine whether mood on one day could predict changes in identity dimensions the next day (see Table 4). Mood did not predict any changes in identity dimensions regarding the best friend. However, lagged effects from mood to educational identity dimensions were found. Specifically, anger predicted increases in educational reconsideration, but did not predict changes in educational commitment and in-depth exploration. Anxiety predicted increases in educational in-depth exploration and reconsideration, but did not predict changes in educational commitment. Finally, sadness predicted increases in educational reconsideration.

Overall, the findings partly confirm hypothesis four, as there were indeed effects from identity to mood and the other way around. However, there were relatively few effects in both directions and significant predictive paths were only significant at $p < .05$.

Gender differences. Significant gender effects emerged in only three of the 54 models, which is exactly the number of models in which we would expect moderation to occur by chance given a *p*-value of .05. The three significant moderation effects indicated that the stability path of commitment regarding the best friend, and the concurrent

TABLE 4
Regression Coefficients (and Standard Errors) From Multilevel Analyses Describing Within-Person Cross-Lagged Relations in Which a Change in Each Identity Variable is Predicted by Mood Assessed the Previous Day

	Educational Identity			*Relational Identity*		
	Commitment	*Exploration*	*Reconsideration*	*Commitment*	*Exploration*	*Reconsideration*
Anger	.000 (.002)	.004 (.003)	.004 (.002)*	.002 (.002)	−.001 (.002)	.001 (.002)
Anxiety	.001 (.002)	.006 (.003)*	.006 (.002)*	.002 (.002)	−.003 (.003)	.002 (.002)
Sadness	−.001 (.003)	.000 (.004)	.006 (.002)*	.001 (.003)	−.005 (.003)	.002 (.002)

Note. All autocorrelation effects of identity dimensions predicted by the same identity dimensions on the previous day were significant ($p < .001$), but these are not reported. *$p < .05$.

associations of educational exploration with anxiety and of educational commitment with sadness, were weaker for boys than for girls.

DISCUSSION

The present study provides a first examination of the longitudinal associations between identity and mood from early to late adolescence. For this purpose, we examined identity and negative mood in a 75-day diary study covering a 5-year period. We found that identity and mood were associated with one another in the average adolescent, with some differences between identity domains. In addition, there was some evidence that identity processes (particularly reconsideration) and mood affected each other on a day-to-day basis.

First and foremost, we found that identity and mood were associated with each other within days within the average adolescent. Specifically, individuals generally reported relatively more anger and sadness on days at which they reported relatively less commitment and more reconsideration regarding both education and their best friend. Mood variability is particularly characteristic for adolescents (Arnett, 1999; Hall, 1904), and our findings suggest that this mood variability is associated with the key developmental task of this period, that is, identity formation (Erikson, 1950). The reconsideration and commitment dimensions of the model of identity formation used in the present study aim to capture Erikson's (1950) identity synthesis versus identity confusion dynamic (e.g., Klimstra, Luyckx et al., 2010). Therefore, our findings suggest that it is not only individuals who are generally closer to identity synthesis that display a general tendency toward better mood (e.g., less depressive symptoms) than individuals closer to identity confusion (i.e., a between-person association; Crocetti, Rubini, Luyckx & Meeus 2008; Luyckx et al., 2006, 2008). In fact, our findings show that individuals on average also tend to have better moods at times when they are closer to identity synthesis (i.e., a within-person association). Such results had already been obtained in research on ethnic identity (e.g., Yip, 2005; Yip & Fuligni, 2002) and purpose in life (e.g., Kiang, 2012), but are new to the field of study of personal identity. Thus, our findings extend previous research that provided evidence for an identity synthesis versus confusion dynamic on a day-to-day between-person level (Klimstra, Luyckx et al., 2010). We now showed that this dynamic also operates at the within-person level and is associated with changes in mood.

In general, associations of identity dimensions with mood differed across the educational and relational domains. Specifically, all within-time associations between identity and mood were significant for the educational domain, whereas only five of nine associations reached significance in the best friend domain. These findings were in line with previous research using different techniques (i.e., between-person associations) to examine how identity and mood valence were related to each other (Meeus et al., 2005). The educational domain has been described as a closed domain, in which it may be hard to change an unsatisfying commitment, at least in the Dutch cultural context (Meeus et al., 1999). Specifically, once enrolled in a specific high school track, individuals cannot change for at least the rest of the year. In open domains, such as interpersonal domains (e.g., friendships), individuals can change their commitments relatively easily. This point is backed up by previous empirical findings suggesting that there is more change in interpersonal than in educational dimensions and that a (fore)closure status (committing with no [further] exploration) is a more common end point for educational identity than for interpersonal identity (Meeus et al., 1999). As a result of these differences between domains, weak commitments or reconsideration of commitments could be less threatening

for adolescents when this uncertainty arises in open rather than in closed domains. This might explain why identity dimensions regarding the best friend were weaker related to mood when compared to educational identity dimensions. Another reason for the weaker linkages of mood with identity dimensions regarding the best friend could be that adolescents generally tend to enjoy contacts with friends. These contacts bring few responsibilities, whereas the educational context does bring responsibilities that may challenge autonomy. Hence, adolescents may associate the educational context with more negative emotions, leading identity processes in this domain to be more strongly associated with mood when compared to identity processes in the specific friendship domain we studied.

The relatively closed nature of the educational domain when compared to the friendship domain could also be responsible for what was perhaps one of our most striking findings. That is, in-depth exploration was positively associated with anger, anxiety, and sadness, but only in the educational domain. Thus, despite the positive effects that reflecting on one's identity can potentially have (Crocetti, Rubini, & Meeus, 2008; Luyckx et al., 2008), it can be negatively associated with mood. Recent work suggests that in-depth exploration may consist of two aspects, with one aspect being highly correlated with a ruminative type of exploration (Zimmermann, Lannegrand-Willems, Safont-Mottay, & Cannard, 2015). In-depth exploration may cause individuals to get stuck in their reflections on their current commitments (Luyckx et al., 2008), resulting in a worse mood. The educational context may already be more frustrating and demanding when compared to the relatively free and fun-laden friendship context. Furthermore, because adolescents are (at least in the Netherlands) somewhat stuck with their choices in relatively closed domains such as education (Meeus et al., 1999) due to the availability of relatively few alternatives, reflection may lead to frustration and hence turn into rumination in such closed domains. Our findings therefore seem to underscore the importance of distinguishing adaptive from maladaptive types of exploration (Luyckx et al., 2008; Zimmermann et al., 2015).

We also found that identity and mood affect each other across time. However, it should be noted that these effects were only significant at the .05 level and modest in magnitude. Five of the 18 possible effects of identity on mood were significant. Particularly striking was that four of these were effects of in-depth exploration on mood. Reflecting on both one's education and one's friendships appears to negatively affect one's mood on the next day. This might again be due to reflection turning into rumination (Luyckx et al., 2008; Zimmermann et al., 2015). The consistency of these effects (i.e., four of the six possible cross-time associations between in-depth exploration and mood were significant) underscores that exploration processes, which theoretically lead to a stronger and better-integrated identity in the long run, can lead to short-term increases in negative mood.

In addition to findings involving in-depth exploration, we found an effect of reconsideration regarding the best friend on sadness. However, given that this effect did not emerge for the other mood indicators or educational reconsideration, it should be interpreted with caution. Generally speaking, the across-day (i.e., cross-lagged) associations extend findings regarding within-day associations. It appears that negative emotions occurring on days when individuals reflect extensively on their commitments carry over and worsen the day after. That is, these findings suggest that identity on one day predicts relative *changes* in mood on the next day (e.g., Gottman, 1990; Granger, 1969). Thus, we found some evidence for Erikson's (1950) assertion that identity might predict changes in mood.

There was also some evidence for effects in the inverse direction, suggesting that identity is also partly rooted in emotions (Kunnen et al., 2001). One such effect, of anxiety on educational in-depth exploration, may not be replicable, as it only emerged for one of the three mood indicators and in one identity domain. Effects of mood on educational reconsideration appeared to be more robust, as all three mood indicators (anger, anxiety, and sadness) affected this dimension. This indicates that a negative mood on one day might predict an increase in doubts regarding one's education the next day. The mechanism at work here might be that adolescents experience a negative mood on one day and attribute this to their main activity of that day, which is usually school. In an attempt to deal with the stressor that in their view caused their negative mood, they start to doubt their education and consider alternatives. This process is reflected in increased educational reconsideration the following day. These findings may illustrate one way in which identity, and changes therein, can indeed emerge from emotions (Kunnen et al., 2001). Although we think that the mechanism we propose is plausible, qualitative data (e.g., inter-

views), moment-to-moment data (Lichtwarck-Aschoff et al., 2008), or an experimental design (Kerpelman & Pittman, 2001) would be needed to obtain a better understanding of the exact mechanisms through which emotions impact identity processes.

Quite striking with regard to the across-day effects is that the educational domain instead of the relational domain appears to be most affected by mood. This is noteworthy because the relational domain is typically described as more open to change than the educational domain (Meeus et al., 2005). Nonetheless, it appears to be the educational domain in which adolescents attempt to impose change to unsatisfying commitments when they experience a negative mood. This could be due to the educational activities being perceived as less enjoyable than activities within the friendship context and that mood particularly affects identity processes in domains of which one enjoys the activities less. However, it may also be that the educational domain is more central to their sense of self than the friendship domain (Bosma, 1985). That is, the educational domain plays a key role in the later stages of adolescence, because educational performance is an important predictor of eventual socioeconomic status. As a result, adolescents may therefore more readily turn their focus to this domain when trying to achieve changes in their identity. In related research on, for example, racial identity, centrality of domains did moderate associations between identity and psychological well-being (e.g., Rowley, Sellers, Chavous, & Smith, 1998). Yet, domain centrality is rarely considered in research on personal identity formation. In research on personal identity formation in general, and in our study in particular, information on domain centrality may have provided us with greater insight into the mechanisms behind our findings.

Our study provided little evidence for gender differences in the associations between identity and mood. In fact, the few gender differences that we did find likely emerged because of the large number of tests we conducted. Hence, it can be concluded that much like with between-person associations of identity with mood disorder symptoms (Schwartz et al., 2012), within-person associations between identity and mood are largely similar for adolescent boys and girls.

Strengths and Limitations

The primary strength of the present study was its reliance on diary data on identity and mood collected on a total of 75 days across a 5-year period in a relatively large sample of adolescents. This design allowed us to assess how mood and identity were associated with each other, and predicted one another, within particular individuals throughout adolescence.

There were also several limitations that need to be acknowledged. First, all measures were self-reported. Identity refers to a subjective feeling of sameness and continuity and therefore needs to be self-reported (Erikson, 1950). However, several aspects of mood, such as anger and anxiety, are highly visible and can therefore be reliably reported by observers (cf. Ekman & Friesen, 1975). Using such observer ratings would have decreased the shared-method variance that may now affect our results. Second, the single-item identity measures come with inherent limitations. For example, the reliability of identity dimensions assessed on one particular day cannot be calculated; there is a risk that single-item scale scores represent random responses; and single-item scales lack the breadth of content of multiple-item scales. Therefore, single-item measures should only be used in settings like diary studies, in which time and space limitations make full-length measures impractical (e.g., Robins, Hendin, & Trzesniewski, 2001).

Third, we only focused on one particular part of the broader construct of identity, namely personal identity formation processes. The construct of identity encompasses additional aspects, such as gender identity (see Bussey, 2011) and ethnic identity (see Umaña-Taylor, 2011). However, we chose to follow Erikson's (1950) early focus on identity formation as a process that mainly takes place in ideological domains (i.e., education) and the extension of that focus by Grotevant et al. (1982) into interpersonal domains (i.e., relationship with the best friend).

Fourth, the present study only sampled nonclinical adolescents, which has potential implications for the generalizability of the findings. The nonclinical nature of our sample might have affected the results, as mood fluctuations tend to be more pronounced in, for example, individuals diagnosed with major depression (Silk et al., 2011) or borderline personality disorder (Trull et al., 2008). Whether mood is also differentially associated with identity processes in such populations provides an interesting endeavor for future research.

Fifth, we only sampled Dutch adolescents and it is unclear to what extent similar findings can be obtained in other countries. The educational context for Dutch adolescents requires individuals to choose a particular high school curriculum in the

third year of secondary education (i.e., at age 14–15). Educational identity formation as measured in the present study is therefore already relevant in early adolescence in the Netherlands (Klimstra et al., 2012). This may have an impact on the associations between educational identity formation and mood in the Netherlands when compared to other countries.

Sixth, the three emotions that we distinguish are highly correlated with each other (i.e., .57–.81). As this is a common finding in the literature, some studies (e.g., Maciejewski et al., 2014) use latent general emotional dysregulation factors when relating daily emotions to other constructs. However, there are subtle differences in the effects of different emotions on, for example, different forms of psychopathology (Silk, Steinberg, & Morris, 2003). Because of that, and because high correlations at the between-person level do not necessarily generalize to the within-person level (Vansteelandt et al., 2005), we opted for the more precise emotion-specific approach. Our findings do support our choice for this approach, because we found subtle differences in the associations of specific emotions with identity processes.

Seventh, it is important to realize that all the discussed findings refer to how identity and mood relate to one another in the average adolescent. However, all these mean associations have standard errors, which point to individual differences in the extent to which identity and mood relate to one another. Thus, in some individuals particular identity dimensions, such as educational commitment, may be positively associated with, for example, sadness, whereas this association may be smaller or even negative in other individuals. In addition, the distribution of these within-person associations is different for each of the associations. For example, in absolute terms, the mean within-person concurrent association between relational reconsideration and anger is about as large as the mean within-person concurrent associations between education commitment and sadness (|.31| and |.32|, respectively). Yet, the standard error for the former association is twice as large as the standard error of the latter association. Thus, weak educational commitments tend to go together with a sad mood in most individuals, whereas relational reconsideration goes together with anger, but much more in some individuals than in others. Hence, our results are informative on the extent to which interindividual differences are present in within-person associations between identity and mood. To better illustrate such individual differences in concurrent associations, typological approaches such as cluster analysis or latent class analysis can be used. For example, Klimstra et al. (2011) showed that there are groups of individuals whose moods are substantially associated with the weather, whereas there is also a large group of individuals in which associations between weather and mood are virtually nonexistent. To the best of our knowledge, such typological approaches are not possible with lagged relations. To keep our study focused, we concentrated on uncovering whether or not there were within-person associations between identity and mood and whether these associations carried over from 1 day to the next. Future studies could focus on the shape and causes of individual differences in these within-person associations.

CONCLUSION

Notwithstanding these limitations, this study provides a considerable leap forward in our understanding of the linkages between adolescent identity formation and mood. Specifically, individuals tend to have better moods at times at which they have a stronger sense of identity, and there was even some evidence for effects across days. Thus, there was strong evidence for identity formation being associated with mood variability, but these associations appear to be slightly different depending on the particular identity domain under consideration.

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