EMPIRICAL RESEARCH

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A Longitudinal Investigation of Cognitive Self-schemas across Adolescent Development

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Abstract
Research in developmental psychology highlights youth's self-schemas as one possible pathway to improve adolescents' functioning and promote positive developmental outcomes. Despite this, the trajectory of *positive* and *negative* self-schemas is relatively understudied. This study addresses this limitation by empirically examining the trajectory of self-schemas in a community sample of 623 youth ($M = 13.04$ years; 54% female; 49% African American, 4% Biracial, 47% European American) who were followed over a seven-year period. Caregivers completed measures of parenting practices, maternal rumination and negative inferential style, and adolescents completed a computerized behavioral task assessing self-schemas (i.e., mental frameworks that guide attention, interpretation, and memory of one's experiences). Multilevel growth curve modeling results demonstrated a quadratic slope for negative self-schemas and no mean-level change for positive self-schemas. These trajectories did not vary by gender or racial group. However, parenting factors differentially influenced the trajectories. Specifically, higher levels of parental involvement at baseline, or an active interest and engagement in a child's experiences and activities, related to lower levels of negative self-schemas during adolescence. Additionally, higher levels of parental rumination and parental negative control at baseline related to lower levels of youth positive self-schemas at baseline. These findings contribute to models of youth cognitive development.

Keywords Cognitive Self-Schemas · Adolescence · Longitudinal · Self-referent Encoding

Introduction

It has been argued that more inclusive and complete models of youth development should include both positive and negative aspects of mental health (Keyes 2002). Research in developmental psychology highlights youth's self-schemas —positive (e.g., "I am smart") and negative (e.g., "I am stupid") core beliefs about the self that impact how one

attends to, interprets, evaluates, and remembers their experiences (Beck 1967)—as one possible pathway to improve youth's functioning and promote positive developmental outcomes (Keyfitz et al. 2013). Yet, despite their potentially unique relevance for adolescent development, few empirical investigations have examined the stability and course of self-schemas during adolescence. The current study addresses this limitation by exploring the trajectory of both positive *and* negative self-schemas during adolescence over the course of a seven-year period.

Stability of Negative and Positive Self-Schemas

Theory suggests that schemas develop throughout childhood and exhibit stability over time (Beck 1967). Indeed, research has shown that negative self-schemas develop early in life (see Dozois and Beck 2008, for a review), are often well established by adolescence (Alloy et al. 2012), and tend to show stability throughout adulthood (Dozois 2007). However, it is unclear when stability of self-schemas takes place during adolescence. Given that adolescence is a

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period of significant social, emotional, biological, and contextual change (Steinberg 2017), it is possible that self-schemas may show patterns of change during this developmentally sensitive period (Jacobs et al. 2008).

Overall, little research has examined the long-term trajectory of positive and negative self-schemas specifically during adolescence; and even fewer studies have used multiple waves of data and laboratory (vs. self-report) paradigms (which arguably best measure the latent structure of self-schemas). Only two studies (Goldstein et al. 2015; Hayden et al. 2013) have examined the long-term stability or trajectory of both positive and negative self-schemas during childhood, using a behavioral task. Hayden and colleagues (2013) found that across two years in middle childhood (ages 7–9), negative and positive self-schemas, as measured by the Self-Referent Encoding Task (SRET; Derry and Kuiper 1981; Hammen and Zupan 1984), both were stable ($r = 0.26 – r = 0.39$, $p < 0.01$, $r = 0.24 – r = 0.25$, $p < 0.01$, respectively) and both exhibited mean-level increases across time. Similarly, Goldstein and colleagues (2015) examined 434 children at age 6 and again at age 9, finding that negative and positive self-schemas, as measured by the SRET, both exhibited significant stability ($r = 0.10$, $p < 0.05$, $r = 0.24$, $p < 0.001$, respectively), and both exhibited mean-level increases across time.

The extant literature's findings on the modest stability of laboratory measured negative and positive self-schemas is in line with the small body of additional work examining the stability of self-schemas using self-report measures only. Importantly, however, much of this research has been conducted among adults, across only two-waves of data collection (e.g., Alloy et al. 2000; Lemoult et al. 2017), or has been limited by short-term follow-up periods in adolescence (e.g., Friedmann et al. 2016; Hankin 2008). The current study addresses these limitations by using longitudinal methods to determine when cognitive self-schemas change and when they exhibit enduring properties.

Factors Impacting the Stability of Self-Schemas

In addition to understanding the developmental pattern of self-schemas during adolescence, there is also a need to understand how factors such as gender, racial group, parenting practices, and maternal rumination and negative inferential style are associated with change in self-schemas. Recognizing that self-schemas do not operate in isolation, knowing the unique individual features and parental characteristics that differentially influence schema development provides important information for theoretical models of youth development.

Gender has been shown to affect how youth develop across a broad range of areas, such as, abilities and interests, self-concept and identity, social relationships, and mental health (see Perry and Pauletti 2011, for a review). Although most research examining self-schemas generally only has included gender as a covariate (Friedmann et al. 2016; Goldstein et al. 2015; Hankin 2008; Hayden et al. 2013), there is some cross-sectional evidence suggesting that positive self-schemas evidence stronger relations to outcomes of happiness and life satisfaction for females than for males (Tomlinson et al. 2016). Additionally, higher levels of negative self-schemas predicted higher levels of suicidal ideation over time among adolescent girls, but not adolescent boys (Burke et al. 2016). These findings highlight that self-schemas have differential relations to various outcomes for males and females. However, it is also important to understand whether the natural process of how self-schemas develop differ by gender. Thus, the current study sought to extend extant knowledge by examining how gender affects the trajectory of positive and negative self-schemas during adolescence.

Despite evidence of significant differences during adolescent development for youth from different racial groups (Adams et al. 2006; Wakefield and Hudley 2007), race often has been overlooked in the self-schema literature. Generally, research in this area focuses primarily on European American samples (Friedmann et al. 2016; Hayden et al. 2013; Lemoult et al. 2017), includes race as a covariate (Goldstein et al. 2015), or excludes race completely from analyses (Hankin 2008). To provide detailed information about self-schema development for African American and European American youth, the current study aimed to examine the impact of racial group on the trajectory of both positive and negative self-schemas during adolescence.

Parenting is also an important factor that may influence the trajectory of self-schemas. Parenting is considered foundational for the development of self-schemas (Young et al. 2003) and much research has shown a relation between the parenting context and the development of negative self-schemas, but has not examined parenting and positive self-schemas (Garber and Flynn 2001; for an exception see Lumley et al. 2011). Despite this oversight, extant research suggests that a lack of parental involvement (i.e., an active interest and engagement in a child's experiences and activities), permissive or lax discipline (i.e., a parent's emphasis on autonomy, but in a way that suggests lack of engagement), as well as high levels of parental control or criticism (i.e., a parent's attempts to control a child's behavior in psychologically harmful ways), may prompt the development of negative self-schemas (Garber and Flynn 2001). Although this empirical research is important, much of this work is cross-sectional in nature limiting the understanding of how parenting may impact the trajectory of negative self-schemas during adolescence and does not address the direction of the association between parenting and self-schemas. Further, the consideration of

positive schemas is virtually absent from this body of literature. To clarify the role of parental involvement, lax discipline, and parental control as potential parenting factors that may influence the stability of both positive and negative self-schemas during adolescence, the current study examined the impact of parenting on the trajectory of positive and negative self-schemas.

Finally, maternal negative inferential style (i.e., tendency to infer internal, stable, and global causes, negative consequences, and negative self-worth from the occurrence of negative life events) and maternal rumination (i.e., recurrent focus given to comparing one's current situation to an unachieved standard), also have been associated with youth's cognitive perspectives (Alloy et al. 2001), and are important to consider when examining factors that may impact the trajectory of self-schemas during adolescence. Early work in this field found that a mother's inferential style about the causes of negative events was significantly related to that of her child (Seligman et al. 1984). Additionally, maternal rumination is thought to be one possible mechanism in the intergenerational transmission of cognitive vulnerabilities (Gotlib and Joormann 2010). Within the field of personal narratives and identity development, parent-child communication is seen to provide the foundation for youth to evaluate the meaning of personal events and develop a personal narrative (McAdams and McLean 2013; McLean and Pratt 2006), and maternal rumination and negative inferential style may represent a context in which negative self-messages are reflected or modelled by mothers. Specifically, parents who are warm, open, and communicate about factual aspects of an event have adolescents with higher levels of well-being, but those who engage in repetitive conversation about the emotions associated with an event (i.e., rumination) have youth who show poorer functioning (for a review, see Fivush et al. 2010). Given that both maternal rumination and negative inferential style represent negative perceptions of the self and have unique associations with youth's mental health, it may reasonably follow that youth's self-schemas are influenced by these maternal factors. To address this hypothesis, an additional goal of the present study was to examine the impact of maternal rumination and negative inferential style on the trajectory of positive and negative self-schemas during adolescence.

Current Study

The primary aims of the current study were (1) to investigate the developmental trajectories of both positive and negative self-schemas over the course of adolescence, and (2) to determine whether gender, racial group, parenting practices, and maternal rumination and negative inferential style influence their course. In line with limited extant literature using a behavioral task to measure both positive and negative self-schemas (Goldstein et al. 2015; Hayden et al. 2013), it was hypothesized that significant change in both positive and negative self-schemas during adolescence would be observed. However, given the limited research on self-schema development specifically during the adolescent period, no a priori hypotheses were made about the direction or shape of the expected change.

Based on research suggesting that males and females often evidence different patterns of development during adolescence (Perry and Pauletti 2011), it was hypothesized that females and males would exhibit significantly different trajectories of positive and negative self-schemas. Specifically, given the relationship found between self-schemas and mental health (e.g., well-being, happiness, suicidal ideations) for females, and the lack of association for males (Burke et al. 2016; Tomlinson et al. 2016), it was hypothesized that females would show a greater rate of growth in both positive and negative self-schemas across adolescence, whereas males would show more stable trajectories.

Given the lack of previous research relating racial group to self-schema development during adolescence, this factor was included as an exploratory variable. In light of the sparse literature in this regard, no specific hypothesis was made about the impact of racial group (i.e., African American vs. European American) on the trajectories of positive and negative self-schemas.

In line with the research suggesting that negative parenting practices, such as a lack of parental involvement, lax discipline, or high levels of parental control, relate to the development of negative self-schemas (Garber and Flynn 2001), it was hypothesized that low levels of parental involvement and high levels of lax discipline and parental control would relate to a slower rate of growth in positive self-schemas and a greater rate of growth in negative self-schemas during adolescence, whereas high levels of parental involvement and low levels of lax discipline and parental control would have the opposite effect. With regards to positive self-schemas, this is the first study to examine the relationship between parenting practices and positive self-schema development across a seven-year period during adolescence. As such, a speculative hypothesis was made that low levels of parental involvement, high levels of lax discipline, and high levels of negative control would relate to a slower rate of growth in positive self-schemas during adolescence. Alternatively, it was hypothesized that high levels of parental involvement, and low levels of lax discipline and negative control, would relate to an increased rate of growth in positive self-schemas during adolescence.

In keeping with past research suggesting that maternal negative inferential style and maternal rumination can impact youth's self-views (Alloy et al. 2001; Gotlib and

Table 1 Demographics and Study Completion

Variable	Mean (SD)	N (%)
Female	–	333 (53.5%)
Male	–	290 (46.5%)
African American	–	306 (49.1%)
Biracial	–	26 (4.2%)
European American	–	291 (46.7%)
Eligible for free lunch	–	310 (49.8%)
Average Age (in years)		
Time 1	13.04 (0.88)	–
Time 2	14.36 (0.98)	–
Time 3	15.23 (0.94)	–
Time 4	15.98 (0.71)	–
Time 5	17.13 (0.73)	–
Time 6	17.98 (0.72)	–
Time 7	18.92 (0.68)	–
Time 8	19.82 (0.60)	–
Number of Sessions Completed*	–	
1	–	623 (100%)
2	–	399 (64.0%)
3	–	291 (46.7%)
4	–	197 (31.6%)
5	–	119 (18.5%)
> 5	–	64 (10.3%)

Note. *Number of Sessions Completed reflects the number of participants in this sample who completed the Self-Referent Encoding Task (SRET) at any follow-up assessment as of the time of these analyses. Project ACE is still underway and retention rates are likely to change as participants continue in the study. At the time of this manuscript, 80% of ACE participants completed at least one follow-up visit, and 72% of the sample is continuing in the study. The average retention rate for this study, based on participants who have completed the SRET at least once at a follow-up visit and are classified as actively continuing in the study, was 64%

Joormann 2010), it was hypothesized that youth with mothers who reported higher levels of maternal rumination/negative inferential style would have higher rates of growth for negative self-schemas and lower rates of growth for positive self-schemas during adolescence. Alternatively, it was hypothesized that youth with mothers who reported lower levels of maternal rumination/negative inferential style would exhibit the opposite pattern of self-schema development.

Methods

Participants and Procedure

Participants were recruited for the Temple University Adolescent Cognition and Emotion (ACE) Project, a prospective longitudinal study of depression onset in adolescence (Alloy et al. 2012). Adolescents and their primary female caregivers (93% were biological mothers) were recruited from public and private middle schools and through advertisements in local newspapers in the Philadelphia area. Prior to inclusion in the study, phone screening interviews were completed to ensure eligibility. Participants were required to be 12 or 13 years old at study entry and to self-identify as European American, African American, or Biracial (which was representative of the population in this area and relevant to one of the Project ACE goals to examine European American vs. African American differences in onset of depression). Exclusion criteria included: 1) not being able to read or speak English well enough to complete study assessments, or 2) the diagnosis of a severe psychiatric, developmental, medical, or learning disorder in either the adolescent or caregiver that would prevent adequate study participation. Informed consent was obtained from all individual participants included in the study. See Alloy et al. (2012) for further details about Project ACE. At the time of this manuscript, 87% of participants completed at least one follow-up visit, and 71% of the sample is continuing in the study. Project ACE is still underway and retention rates are likely to change as participants continue in the study. Here it is reported how the sample was determined, all data exclusions that were made, and the measures assessed.

The current study included 623 adolescents (M age at baseline = 13.04 years ± 0.88) who had completed at least one time point. See Table 1 for information about the current sample and completed study assessments. At Time 1 (T1), caregivers completed a demographic questionnaire and a measure of parenting practices (CRPBI; Raskin et al. 1971), rumination (RRS; Treynor et al. 2003), and negative inferential style (PCSQ; Alloy et al. 2000; Haeffel et al. 2008), while the adolescents completed a computerized behavioral task (SRET; Derry and Kuiper 1981; Hammen and Zupan 1984) assessing information processing biases involved in the preferential processing of negative and/or positive self-referent information or self-schemas. Adolescents were invited back to the lab to complete the same version of the behavioral task at approximately 12-month intervals for the length of their participation in the study. Mothers and adolescents were reimbursed for their participation after each assessment.

Adolescents included in the present sample were followed over the course of a seven-year period. When compared to adolescents who completed at least one follow-up assessment, adolescents who completed the T1 assessment only significantly differed on two of the primary study variables—negative control, and rumination (See Table 2). Specifically, adolescents who only completed the T1 visit were more likely to have parents who reported using higher levels of negative control and rumination at baseline.

Table 2 Comparison of participants who completed Time 1 only and participants with at least one follow-up assessment

Variable	Completed Time 1 only		Completed follow-up		t/χ^2	p
	M (SD)	N	M (SD)	N		
Sex (Male/Female)		103/121		187/212	0.05	0.83
Racial group (White/Black)		112/112		179/220	−1.52	0.22
Eligible free lunch (N/Y)		93/118		206/179	4.85	0.03
Positive Schemas Time 1	0.27 (0.16)		0.29 (0.14)		−1.47	0.14
Negative Schemas Time 1	0.17 (0.31)		0.22 (0.34)		−1.61	0.11
Involvement	57.55 (5.37)		57.07 (5.30)		1.04	0.30
Negative control	26.93 (5.17)		25.88 (4.85)		2.42	0.02
Lax discipline	26.85 (2.69)		27.27 (2.69)		−1.83	0.07
Negative inferential style	2.98 (0.95)		3.00 (0.93)		−0.25	0.80
Rumination	9.73 (3.29)		8.96 (2.91)		2.43	0.02

Note. *t*-tests were used for continuous variables and chi-square tests were used for categorical variables

Measures

Demographics

Caregivers completed a demographic self-report questionnaire at the beginning of the T1 assessment. The questionnaire consisted of multiple choice items assessing the caregiver's relationship to the adolescent (e.g., biological parent), their age and race, as well as their child's age and race.

Self-schemas

The Self-Referent Encoding Task (SRET; Derry and Kuiper 1981; Hammen and Zupan 1984) is a computerized behavioral task that assesses information processing biases involved in the preferential processing of negative and/or positive self-referent information or self-schemas. Within each trial of the task, an adjective appeared on the screen along with a question prompting participants to make either a self-referent ("Like Me?") or structural ("Has an 'E'?'") judgment, in which they must indicate whether the adjective either describes them or contains the letter "E," depending on trial condition. The current version of the SRET included 22 positive (e.g., happy, attractive) and 22 negative (e.g., awful, lonely) adjectives (see Hammen and Zupan 1984 for detailed information about the selection of adjectives). Positive and negative stimuli were divided between the self-referent and structural conditions so that each valence/ judgment pairing contained 11 words. Adjectives were matched on length and word frequency and were presented in random order. Immediately following this endorsement portion of the SRET, adolescents were administered an incidental free recall test in which they received a maximum of five minutes to verbally recall as many adjectives as they could from the task. Two self-schema scores were calculated: a positive self-schema score (the proportion of positive words both rated as self-descriptive and subsequently recalled relative to all words rated as self-descriptive) and a negative self-schema score (derived in the same way using negative words; Hayden et al. 2013; Johnson et al. 2007). The SRET was programmed using E-Prime software. The SRET was administered at each time point. It has been shown to be a reliable measure of self-referent cognitions for adolescents (see Dainer-Best et al. 2018, for a review).

Parenting

The Children's Report of Parental Behavior Inventory-Revised Version (CRPBI; Raskin et al. 1971) was used to provide a self-report measure of parenting practices at T1. The revised version of the CRPBI is a 90-item measure administered to caregivers and each item describes a discrete sample of parental behavior (e.g., "I often praised my child") that the participant rates as "like," "somewhat like," or "not like" their interactions with their child over the past year. Of the 90 items, 48 items were found, based on a factor analysis (Raskin et al. 1971), to comprise three primary scales—Involvement, Negative Control, and Lax Discipline. The CRPBI has shown good reliability when used with adults ($\alpha = 0.81$ to $\alpha = 0.94$; Raskin et al. 1971), as well as good convergent and discriminant validity (Safford et al. 2007). For the current study, the CRPBI yielded moderate reliability for the three subscales at T1 ($\alpha = 0.79$, $\alpha = 0.79$, and $\alpha = 0.70$, respectively).

Parental cognitive vulnerabilities

The Parent's Cognitive Style Questionnaire (PCSQ) is a revised version of the Cognitive Style Questionnaire (CSQ; Alloy et al. 2000; Haeffel et al. 2008). The PCSQ was administered at T1 and was developed to measure parents' inferential styles in response to negative life events by

altering the original CSQ items to be applicable to adults (e.g., "you give an important presentation at school, and your classmates say it went badly" was changed to "you give an important presentation at work, and your co-workers say it went badly"). Events within the achievement, interpersonal and appearance domains were assessed. Each of the 12 hypothetical negative events (4 events for each domain) was followed by five follow-up questions measuring parents' tendencies to make inferences about the causes (internal/external, stable/unstable, and global/specific), consequences, and self-worth implications of each event. Responses were provided on a scale of one to five, with higher scores indicative of a more negative inferential style. A total negative inferential style composite score was calculated by summing scores within the internality, stability, globality, consequences, and self-worth dimensions across the event domains (achievement, interpersonal, and appearance). The original CSQ has shown good test-retest reliability in previous research (Alloy et al. 2000). For the current study, the adapted PCSQ yielded excellent reliability at T1 ($\alpha = 0.96$).

The Ruminative Response Scale (RRS; Treynor et al. 2003) is a 10-item, self-report questionnaire used to assess parents' tendencies to engage in ruminative responses when experiencing a down mood (e.g., "When I feel sad, I think about how alone I feel"). The RRS includes two subscales, ruminative reflection and ruminative brooding. For the current study, only the ruminative brooding subscale measured at T1 was used. Ruminative brooding refers to the amount of focus given to comparing one's current situation to an unachieved standard. Items are scored on a scale of 1 to 4, with higher scores indicating more frequent engagement in ruminative brooding. The RRS has been shown to be internally consistent and to be correlated with alternate measures of rumination (Siegle et al. 2004). For the current study, the RRS – Brooding subscale yielded good reliability at T1 ($\alpha = 0.79$).

Data Analysis

First, to examine the trajectories of self-schemas, nested within individuals over the course of eight waves of data collection, multilevel growth curve modeling was employed using Mplus 7.11 (Muthén and Muthén 1998-2015). This analytic method allows for the examination of mean rate of change in positive and negative self-schemas using an idiographic (person-centered) approach. Moreover, this method uses maximum likelihood estimation, which allows for the utilization of data from participants missing data from one or more waves of data collection, expected to occur over a long-term (7-year) follow-up period. Time was centered at baseline, allowing the intercept to reflect self-schemas at age of entry to the study (on average, 13 years).

The slopes of the models reflect the average rate of change across study time points. As outlined previously, the SRET recall score was a proportion score; to accommodate the small proportion score values and ease computational burden, the proportion values were multiplied by 10. Individual assessment times were used to best approximate time. Given the low number of participants who endorsed biracial status as their racial group (4%), these individuals were combined with the African American group because all of the biracial participants were in part African American.

Given the limited research on the trajectories of positive and negative self-schemas between the ages of 13 and 20, and the lack of *a priori* hypothesis about the shapes of the trajectories, all models were first tested with polynomial terms up to the cubic function. If the cubic function was a non-significant outcome, then the quadratic and linear functions were tested respectively. Next, repeating the same process from step one, the trajectories were modeled separately while considering gender (Male/Female) and race (European American vs. African American/Biracial), in independent models, as predictors of the intercept and growth parameters. Finally, the subscales from the CRPBI, PCSQ, and the RRS were examined independently, to determine whether parenting practices, maternal negative inferential style, or maternal rumination influenced the intercept and growth parameters for positive and negative self-schemas.

Results

Trajectories of Negative and Positive Self-Schemas

For the trajectory of negative self-schemas based on the SRET scores from Time 1 to Time 8, a significant intercept ($B = 2.185$, $SE = 0.143$, $p = 0.000$) and slope ($B = -0.059$, $SE = 0.015$, $p = 0.000$) were found for the quadratic growth model (see Fig. 1).

For the trajectory of positive self-schemas, based on the SRET scores, the linear slope ($B = 0.025$, $SE = 0.015$, $p = 0.100$) was not significant (see Fig. 2). The intercept ($B = 2.875$, $SE = 0.058$, $p = 0.000$) for the linear model was significant, suggesting there was significant variability for youth's positive self-schemas at baseline (age 13).

Trajectories by Gender

When entered as a predictor of the intercept and growth parameters for negative self-schemas, gender did not significantly influence the quadratic slope ($B = 0.049$, $SE = 0.068$, $p = 0.473$) or intercept ($B = 0.129$, $SE = 0.247$, $p = 0.601$). Similarly, gender did not significantly influence the linear slope ($B = -0.046$, $SE = 0.030$, $p = 0.129$) of
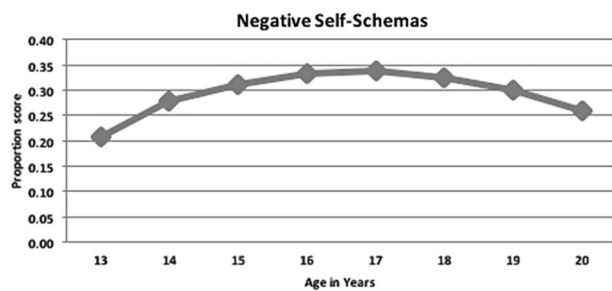
Fig. 1 Significant quadratic slope of negative self-schemas based on Self-Referent Encoding Task (SRET) proportion scores
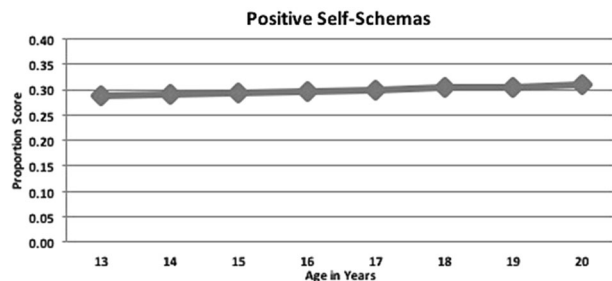

Fig. 2 Non-significant linear slope of positive self-schemas based on Self-Referent Encoding Task (SRET) proportion scores

positive self-schemas. However, gender did significantly influence the intercept for the linear model for positive self-schemas ($B = 0.257$, $SE = 0.116$, $p = 0.026$). Specifically, at approximately age 13, on average, females reported significantly higher levels of positive self-schemas compared to males. See Table 3 for a summary of the results.

Trajectories by Racial Group

When racial group was entered as a predictor of the intercept and growth parameters, racial group did not significantly influence the quadratic slope ($B = -0.026$, $SE = 0.030$, $p = 0.396$) or intercept ($B = 0.182$, $SE = 0.273$, $p = 0.506$) for negative self-schemas, or the linear slope ($B = 0.025$, $SE = 0.032$, $p = 0.424$) or intercept ($B = -0.105$, $SE = 0.116$, $p = 0.369$) for positive self-schemas. See Table 3 for a summary of the results.

Influence of Parenting on Trajectories

Negative control, lax discipline, and parental involvement (measured at T1) were examined as predictors of the trajectories of both positive and negative self-schemas (see Table 3 for a summary of the results). When predicting negative self-schemas, lax discipline and negative control did not significantly influence the intercept or quadratic slope. Parental involvement significantly influenced the quadratic slope of negative self-schemas ($B = 0.006$, $SE = 0.003$, $p = .025$), but not the intercept ($B = 0.010$, $SE =$

Table 3 Model results for the impact of gender, racial group, parenting practices, maternal rumination, and maternal negative inferential style, on the negative and positive self-schema trajectories

	Negative Self-Schemas			Positive Self-schemas		
	B	SE	p	B	SE	p
Gender						
Intercept	0.129	0.247	0.601	0.257	0.116	0.026[*]
Slope	0.049	0.068	0.473	−0.046	0.030	0.129
Racial group						
Intercept	0.182	0.273	0.506	−0.105	0.116	0.369
Slope	−0.026	0.030	0.396	0.025	0.032	0.424
Involvement						
Intercept	0.010	0.029	0.716	−0.003	0.011	0.767
Slope	0.006	0.003	0.025[*]	0.001	0.003	0.686
Lax discipline						
Intercept	0.039	0.072	0.970	0.014	0.022	0.517
Slope	0.005	0.005	0.326	0.007	0.006	0.269
Negative control						
Intercept	−0.037	0.028	0.186	−0.028	0.012	0.018[*]
Slope	−0.003	0.003	0.293	0.005	0.003	0.147
Rumination						
Intercept	−0.012	0.055	0.832	−0.048	0.021	0.019[*]
Slope	0.000	0.007	0.962	0.004	0.005	0.498
Negative inferential style						
Intercept	−0.136	0.161	0.399	−0.003	0.065	0.962
Slope	−0.023	0.016	0.157	0.022	0.018	0.206

Note. Slope refers to the quadratic slope for negative self-schemas and the linear slope for positive self-schemas

*$p < 0.05$

0.029, $p = 0.716$). Specifically, higher levels of parental involvement predicted a lower rate of change in negative self-schemas during adolescence (see Fig. 3), resulting in lower levels of negative self-schemas at ages 14–19, when compared to youth with parents who report lower levels of parental involvement.

When predicting positive self-schemas, parental involvement and lax discipline did not significantly influence the intercept or linear slope parameters. However, negative control significantly influenced the intercept for positive self-schemas ($B = -0.028$, $SE = 0.012$, $p = 0.018$), but not the linear slope ($B = 0.005$, $SE = 0.003$, $p = 0.147$). Specifically, higher levels of negative control related to lower levels of positive self-schemas at baseline, but not did influence the rate of change.

Influence of Maternal Rumination and Negative Inferential Style on Trajectories

Maternal rumination and negative inferential style (measured at T1) were examined as predictors of the trajectories
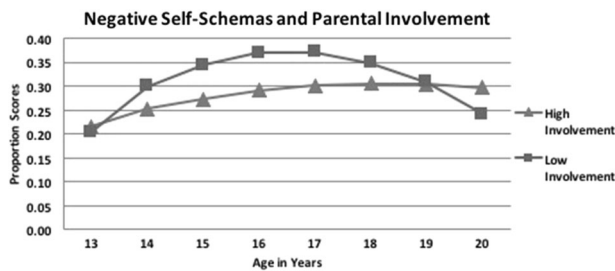
Fig. 3 Impact of parental involvement (at one standard deviation above and below the mean), measured by the Children's Report of Parental Behavior Inventory (CRPBI), on the quadratic slope of negative self-schemas based on Self-Referent Encoding Task (SRET) proportion scores

of both positive and negative self-schemas (see Table 3 for a summary of the results). When predicting negative self-schemas, rumination did not influence the intercept ($B = -0.012$, $SE = 0.055$, $p = 0.832$) or quadratic slope ($B = 0.000$, $SE = 0.007$, $p = 0.962$). When predicting positive self-schemas, rumination significantly influenced the intercept ($B = -0.048$, $SE = 0.021$, $p = 0.019$), but not the linear slope ($B = 0.004$, $SE = 0.005$, $p = 0.498$). Specifically, higher levels of maternal rumination predicted lower levels of positive self-schemas at baseline.

Negative inferential style did not significantly impact the intercept ($B = -0.136$, $SE = 0.161$, $p = .399$) or quadratic slope ($B = -0.023$, $SE = 0.016$, $p = 0.157$) for the negative self-schema model. Similarly, negative inferential style did not significantly impact the intercept ($B = -0.003$, $SE = 0.065$, $p = 0.962$) or linear slope ($B = 0.022$, $SE = 0.018$, $p = 0.206$) for the positive self-schema model.

Alternate Model Analyses

In addition to the results presented in this study, we also examined the interactions between gender and race, respectively, and all parent variables, and found no significant outcomes. The interactions between parent variables and gender or race did not significantly impact the intercepts or trajectories of negative or positive self-schemas, and thus, were not reported in the current paper. Additionally, we initially included socioeconomic status (SES) as another demographic variable of interest when examining factors that may influence the trajectories of positive and negative self-schemas. However, SES and racial group were confounded, and similar results were obtained when exploring both variables independently. Given the limited previous research to support the exploration of SES and self-schema development, as well as the relevance of the SES findings above and beyond the racial group results, SES was removed from the current paper.

Discussion

Examining the stability and course of self-schemas, a fundamental contributor to youth's functioning and adjustment, is an important research priority. Given that adolescence is a developmental period associated with increased cognitive maturation, identity formation, personal exploration and self-growth (Steinberg 2017), it marks a unique period to better understand the consolidation of self-schemas. Despite their relevance for adolescent development, empirical investigations examining the stability and course of self-schemas have lagged. The current study addresses this limitation by exploring the trajectories of both positive *and* negative self-schemas over the course of a seven-year period during adolescence. Further, recognizing that self-schemas do not operate in isolation, this study examines gender, racial group, parenting practices, and maternal rumination and negative inferential style, as potential predictors of the self-schema trajectories.

Using a laboratory task, the long-term trajectories of positive and negative self-schemas were examined over a seven-year period. The findings show that the slope of negative self-schemas was best approximated by a quadratic growth model, suggesting that negative self-schemas increase from early adolescence (age 13) until middle adolescence (ages 16/17), decreasing thereafter. This finding is in line with the two extant studies examining the stability of SRET-measured negative self-schemas among children ages 6–9 and 7–9, respectively, suggesting that negative self-schemas increase in a linear manner throughout middle childhood (Goldstein et al. 2015; Hayden et al. 2013). It may be expected that negative self-schemas would continue to increase in a linear manner from the end of middle childhood until early adolescence (ages 9–13); however, future research should aim to test this gap in development.

The present study is novel in that it is one of the only studies to use a behavioral task to measure the development of positive self-schemas over the course of a seven-year period during adolescence. Results from this study suggest that positive self-schemas are stable during adolescence and do not exhibit mean-level changes. However, there was significant variability in the average level of positive self-schemas at baseline (age 13). This finding differs from the initial proposed hypothesis that positive self-schemas would exhibit change over time, as well as previous work by Hayden and colleges (2013), who found that positive self-schemas had a significant positive linear trend from age 7 through age 9. If the current study findings are replicated, it may suggest that positive self-schemas are developing across middle childhood (7–9 years) and tend to level off or consolidate by age 13. Whereas negative self-schemas appear to increase during adolescence, positive self-

schemas may be viewed as a stable construct that forms at a younger age and becomes consistent by adolescence. Given the high level of stability, these results also may suggest that positive self-schemas are less malleable during adolescence and potentially may be more resistant to the influence of both positive and negative external factors (e.g., life events). However, this is speculative and the current study did not directly test this hypothesis.

When examining the influence of gender on the trajectories of both positive and negative self-schemas, there were no significant differences between the trajectories of positive self-schemas or negative self-schemas for males and females. These findings are not consistent with the proposed hypotheses that females would exhibit a greater rate of growth in both positive and negative self-schemas, whereas males would show more stable trajectories. However, at age 13 (Time 1), females exhibited higher levels of positive self-schemas compared to males. It is unclear why females appear to have a higher level of positive self-schemas at age 13 and additional research is needed to better understand potential mechanisms driving this difference. These findings provide novel information about the development of positive self-schemas and support the need for additional research and replication to define models outlining the unique and nuanced gender patterns that may exist for positive self-schema development.

In addition to understanding the influence of gender on the development of self-schemas during adolescence, it is also important to recognize that these trajectories may differ for African American and European American youth. When modeling the influence of racial group on the intercepts and trajectories of negative and positive self-schemas, there were no significant differences between African Americans and European Americans. Although exploratory, the findings from this study illustrate that on average, African American and European American youth had similar self-schema profiles during adolescence. This finding is not consistent with racial differences noted in other areas of adolescent development (e.g., self-esteem, identity, self-concept; Adams et al. 2006; Wakefield and Hudley 2007), yet this study extends previous work by providing information about self-schema development for African American and European American youth specifically. This is the first study to examine the influence of racial group on the trajectories of both positive and negative self-schemas during adolescence and sheds light on the patterns observed for African American and European American adolescents. However, additional research is needed to further explore this topic while considering other racial groups.

Another aim of the current study was to examine the influence of parenting practices, measured when youth were approximately 13 years of age (Time 1), on the trajectories of positive and negative self-schemas during adolescence.

Supporting the proposed hypothesis, mothers who reported using higher levels (one standard deviation above the mean) of parental involvement at baseline, or an active interest and engagement in a child's experiences and activities, had youth who reported lower levels of negative self-schemas across adolescence. Alternatively, youth with mothers who reported lower levels (one standard deviation below the mean) of parental involvement at baseline evidenced higher levels of negative self-schemas across adolescence. This finding is in line with previous research highlighting that a lack of parental involvement is particularly relevant to the development of negative self-schemas (Alloy et al. 2001; Garber and Flynn 2001). Additional research is needed to illuminate mechanisms by which parenteral involvement relates to the development of negative self-schemas. Given that parental involvement is thought to be associated with an authoritative style of parenting and a secure attachment style, which has been shown to be a robust predictor of a variety of positive developmental outcomes for youth (see Buist 2016, for a review), it may be that those youth who experience higher levels of parental involvement are part of a family system characterized by a strong attachment style. It will be important for future research to consider these variables as possible mechanisms by which parental involvement relates to lower levels of negative self-schemas. Interestingly, lax discipline and negative control did not significantly predict the development of negative self-schemas. This is in contrast to previous cross-sectional findings (Garber and Flynn 2001), as well as the proposed hypotheses that higher levels of negative control and lax discipline, independently, would relate to a greater rate of growth in negative self-schemas across adolescence. Yet, this finding is consistent with work by Hayden and colleagues (2013) who found that, although higher levels of parental criticism (a form of negative control) was positively associated with a faster increase in negative self-schemas (measured by the SRET) for children from ages 7 to 9, the effect failed to reach significance. It may be that negative parenting practices are more strongly aligned with youth's negative self-schemas when examined cross-sectionally as opposed to prospectively, thus explaining the current and past findings.

Adding to the scarce literature on the impact of parenting on the development of positive self-schemas, parenting practices at baseline did not significantly influence the trajectory of positive self-schemas during adolescence. There is little research examining the influence of parenting on the developmental trajectory of positive self-schemas; however, it was hypothesized that positive parenting strategies (e.g., involvement) would relate to a greater rate of growth in positive self-schemas, whereas negative parenting strategies (e.g., lax discipline, negative control) would relate to a slower rate of growth in positive self-schemas. When

examining the cross-sectional relationships between baseline levels of positive self-schemas (age 13; Time 1) and parenting measures, higher levels of negative control, or a parent's attempt to control a child's behavior in a psychologically harmful way, related to lower levels of positive self-schemas. This finding furthers research in this area and is in line with the cross-sectional research highlighting the impact negative control can have on the development of negative self-schemas (Garber and Flynn 2001). Surprisingly, parental involvement did not significantly relate to the development of positive self-schemas during adolescence, or the level of positive self-schemas at baseline. Although existing research regarding such associations is limited, it was hypothesized that positive parenting techniques such as parental involvement would be associated with positive parent-child interactions, and thus, theoretically would support and foster the development of positive self-views. However, it is important to note that there was limited variability in positive self-schemas during adolescence due to the non-significant slope, and thus, the current study may lack the variability needed to determine predictors of change across time. Additional research is required to further understand the parenting factors that are associated with the development of positive self-schemas, as well as the most influential developmental period for change in positive self-schemas. For example, it will be important for future research to explore self-schema development between the ages of 9 and 13, as previous research (Hayden et al. 2013; Goldstein et al. 2015) and the current study have not addressed this age range.

Finally, this study examined the influence of maternal rumination and negative inferential style on the developmental trajectories of negative and positive self-schemas during adolescence. Although it was hypothesized that higher levels of maternal rumination and negative inferential style would, independently, relate to a greater rate of growth in negative self-schemas and slower rate of growth in positive self-schemas, no significant findings were found for the self-schema trajectories across adolescence. With regards to negative self-schemas, these findings differ from past research and theory suggesting that maternal rumination and negative inferential style would influence the development of negative self-views (Alloy et al. 2001; McLean and Pratt 2006). Maternal rumination and negative inferential style both represent maternal inferences about events in their own life and it is theorized that children model through observation similar negative self-views. Yet, it may be that maternal inferences and communication to an adolescent about events in the youth's life may be more impactful for the development of self-schemas. Indeed, research by Garber and Flynn (2001) has shown that even though maternal negative inferential style did not associate with youth inferential style, maternal and child attributions

for the same child-focused events were significantly related. Future research examining the trajectories of self-schemas should include measures of maternal rumination and inferential style targeted at youth's experienced events, to better clarify the impact of these variables on adolescent self-schema development. With regards to positive self-schemas, higher levels of maternal rumination at baseline did cross-sectionally relate to lower levels of positive self-schemas at baseline. This finding supports the research suggesting that mothers who engage in repetitive conversation about the emotions associated with an event (i.e., rumination) have youth who show poorer functioning (for a review, see Fivush et al. 2010), and adds to the limited research specifically examining the relationship between maternal rumination and the development of positive self-schemas. It may be that youth who are regularly exposed to maternal rumination have less opportunity to reflect and integrate positive aspects of the self to their personal identity, and thus, develop lower levels of positive self-schemas. Future research in this area should aim to better understand the mechanisms driving this relationship. Overall, the family context is highly complex, and many parenting characteristics and maternal cognitive vulnerabilities are important to consider when exploring the relations between parental factors and youth self-schemas.

Strengths of the current study include its longitudinal examination of negative and positive self-schemas among a large sample of adolescents uniquely spanning early adolescence to young adulthood. Moreover, the current study employed a laboratory task to assess schemas, providing novel evidence about the course of schema development, which has, to date, primarily relied on self-report measures.

However, it is important to take into account limitations of the current study. First, this study was limited by its sole use of the SRET to measure self-schemas. Future research may implement multiple behavioral and self-report measures of positive and negative self-schemas to increase confidence in the current findings. An additional limitation of the current study is the nature of the parental cognitive vulnerabilities included. Although there are many parental cognitive vulnerabilities that could be considered to impact the course and development of self-schemas, this study was limited to negative inferential style and rumination. Future research may aim to include a parent measure of self-schemas (e.g., SRET for parents) that better aligns with the youth's report. More specifically, positive parental cognitions were not examined in this study, which may have accounted for the current findings suggesting that parental cognitive style did not significantly influence the development of positive self-schemas during adolescence. Indeed, it may be that positive, and not negative, parental cognitions are more impactful for positive self-schema development among youth. Finally, findings may not be fully

generalizable to other racial groups because only African American and European American participants were included in the current study. Future research should aim to explore differences in self-schema development for youth from additional racial groups.

Conclusion

Despite their relevance for adolescent development, empirical investigations examining the stability and course of self-schemas have lagged. The current study addressed this limitation by empirically examining the trajectories of both positive and negative self-schemas for adolescents over the course of a seven-year period. Further, recognizing that self-schemas do not operate in isolation, this study examined gender, racial group, parenting practices, and maternal rumination and negative inferential style, as potential predictors of the self-schema trajectories. Findings support that negative self-schemas follow a quadratic function increasing in early adolescence and decreasing in late adolescence. Of particular importance, this study is the first to examine the trajectory of positive-self schemas over a seven-year period and suggests that positive self-schemas may be stable during adolescence. Whereas negative self-schemas appear to increase during adolescence, positive self-schemas may be viewed as a stable construct that forms at a younger age and becomes consistent by adolescence. Parental involvement was found as the only significant predictor of the negative self-schema trajectory, supporting the relevance of positive parenting practices as a protective factor that buffers against the development of negative self-schemas. Finally, maternal rumination was cross-sectionally related to positive self-schemas at baseline (age 13). This preliminary result may suggest that youth who are regularly exposed to maternal rumination have less opportunity to develop positive self-schemas. Addressing the need for more inclusive and complete models of youth development (Keyes 2002), this study provides empirical evidence for the stability and course of *both* positive and negative self-schemas during adolescence.

Compliance with Ethical Standards

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