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Integrating the Hopelessness Model and the Response Style Theory in an Adolescent Sample

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Abstract

Integrations of cognitive models of depression, specifically, the hopelessness model (Abramson et al. *Psychological Bulletin, 96*, 358–372, 1989) and the response style theory (Nolen-Hoecksema et al. *Journal of Abnormal Psychology, 101*, 405–422, 1992) have been suggested but no previous study has compared the integrations of these models with each other and the original models. Further, previous studies only tested the associations between *composite* scores of inferences, from the hopelessness model, and rumination (incl. brooding and reflection), from the response style theory. Thus, a 3-wave study using self-report instruments with 519 adolescents was conducted (mean age$_{Wave\ 1}$ = 16.09 years; SD = 0.70; 62.7% female; 72.8% European American, 14.7% African-American, 5.4% Latino, 4.4% mixed race/ethnicity, 1.4% Asian/Pacific Islander, 0.8% Native American, and 0.6% identified as "other"). The school serves predominantly working to middle class families and almost one third of the students were eligible for free or reduced lunch programs. AMOS and RMediation were used to calculate and compare five different theory-driven models. The findings of the study provide support for an integrated model in which both brooding and reflection are influenced by individual inferences and interact with individual inferences while affecting depressive symptoms. In addition, reflection plays an unexpectedly important role in this integrated model. Age and cognitive development are discussed as possible explanations for this finding.

Keywords Depression · Hopelessness model · Response style theory · Rumination · Adolescents

Depression is a developmental phenomenon (Lakdawalla et al. 2007) with rates of subsyndromal depression and Major Depression significantly increasing from as low as 2% during childhood (Bufferd et al. 2012) to over 20% during adolescence (Kessler et al. 2012). Although adolescence represents a critical period for the development of depression, it is often neglected (Jacobs et al. 2008). For example, over the past several decades, different cognitive theories of depression have been developed, empirically tested, and gained widespread popularity (i.e., hopelessness model; Abramson et al. 1989 & response style theory; Nolen-Hoecksema et al. 1992). However, most of these studies used adult samples with results having little transferability to adolescents (Abela and Hankin 2008). Thus, while some research has examined how cognitive vulnerabilities to depression emerge and develop during adolescence to explain the increases

in depression over time (Cole et al. 2008; Turner and Cole 1994), much is unknown about how cognitive vulnerabilities begin to interact.

Cognitive Models of Depression

Hopelessness Model Abramson et al. (1989) propose that negative inferences cause depressive symptoms, and this propensity to make negative inferences is referred to as a negative cognitive style. Individuals with a negative cognitive style make negative inferences about a negative event's (1) stability of cause, (2) globality of cause, and (3) consequences, as well as (4) characteristics of the individual themselves following the event. Additionally, individuals with a negative cognitive style make another inference, wherein the cause of a negative event is attributed to internal characteristics, which leads to low self-esteem, another depressive symptom. The current study considers only these components of negative cognitive style, as opposed to other components of negatively-valenced cognitive models of depression (e.g., Mathews and MacLeod 1994).

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Response Style Theory Nolen-Hoecksema et al. (1992) assert that the individual's cognitive response to their depressive mood determines the onset, severity, and length of a depressive episode. Individuals who react by repetitively thinking about their mood and the consequences of the mood have a ruminative response style, which magnifies their depressive mood. This ruminative response style can be divided into brooding and reflection (Treynor et al. 2003). Brooding involves thinking passively about one's depressive mood, whereas reflection involves a problem-solving approach with the goal of understanding one's depressive mood. Only brooding was found to be a consistent predictor of depressive symptoms in adolescents (Mezulis et al. 2011; Verstraeten et al. 2010; Winkeljohn Black and Pössel 2013, 2015). However, findings regarding reflection have been less consistent as some studies found no association with depressive symptoms (Verstraeten et al. 2010; Winkeljohn Black and Pössel 2013, 2015) while others found these associations (Mezulis et al. 2011; Treynor et al. 2003).

Integrating the Hopelessness Model and the Response Style Theory

Researchers have begun integrating different cognitive models of depression into one model (Abela et al. 2009; Alloy et al. 2000; Ciesla et al. 2011; Ciesla and Roberts 2007; Lo et al. 2008; Pössel and Winkeljohn Black 2017; Robinson and Alloy 2003; Spasojević and Alloy 2001). The development of an integrated cognitive model is important as many clinicians already use techniques based on one cognitive model in order to change cognitive constructs proposed in another cognitive model without any theoretical integration to justify this act (i.e., technical eclecticism). For example, in the Penn Resiliency Program (Gillham et al. 1990) adolescents are taught about inferences proposed in the hopelessness model (Abramson et al. 1989) and methods how to challenge them by examining their accuracy and generating alternative inferences, both methods proposed to challenge and change beliefs proposed in Beck's cognitive model (1976).

The development of an integrated cognitive model would allow both researchers and clinicians to move past using techniques and interventions based on isolated constructs from only one model. Further, an integrated model would lend insight into how various techniques may impact cognitive variables from multiple models, and how constructs from different models interact with one another. Finally, a theory-driven integrated model could lead to more effective psychotherapeutic interventions, where techniques from different cognitive models are optimally combined. For example, if brooding mediates the association between inferences and depression, focusing on brooding could lead to a faster and bigger reduction of symptoms than working on negative inferences as such

treatment interrupt the impact of both - inferences and brooding.

In the present study, three possible integrated models will be examined. A mediation model, with rumination mediating the relation between inferences and depressive symptoms. A moderation model, considering main and interaction effects of components of each cognitive model. Last, a model that considers both mediation and moderation of components in each cognitive model will be examined.

Mediation One possible combination of cognitive models is an integration of negative inferences proposed in Abramson et al.'s hopelessness model (1989) and rumination outlined in the response style theory (Nolen-Hoecksema et al. 1992) into a mediation model. Abramson et al. (1989) state that hopeless individuals may ruminate which leads to attention and sleep problems. Thus, rumination could be seen as mediator between negative inferences and depressive symptoms. In their longitudinal study with college students, Spasojević and Alloy (2001) found that rumination mediated the relation between negative inferences (measured as a composite score of negative inferences about stability, globality, consequences, and the self) and future depressive episodes. Similarly, Lo et al. (2008) found that brooding mediated the association between attribution style (measured as a composite score of negative inferences about internality, stability, and globality) and depressive symptoms in two cross-sectional studies with college students and depressed outpatients, respectively. Moreover, reflection did not mediate the association in either sample.

In summary, there is some empirical support for rumination, and for brooding in particular, as a mediator between negative inferences and depressive symptoms. However, it is unclear whether rumination is particularly important for any specific individual negative inferences, nor has any study evaluated rumination (or brooding, specifically) as a mediator in the association between each individual negative inference and depressive symptoms. As negative inferences about stability, globality, consequences, and characteristics of the self but not inferences about internality are proposed to lead to hopelessness (Abramson et al. 1989), one could expect that internality is not associated with rumination.

Moderation Alloy et al. (2000) and Ciesla and Roberts (2007) have proposed another way to integrate negative inferences (Abramson et al. 1989) and rumination (Nolen-Hoecksema et al. 1992). Alloy et al. suggest that individuals who have negative inferences and ruminate about these inferences are more likely to develop depressive symptoms compared to individuals who have only one or neither of these vulnerabilities. Ciesla and Roberts expand on this by proposing that rumination might affect the influence of negative inferences by bringing them to mind more often. In other words, both research teams propose a moderation model to integrate both cognitive

models. One cross-sectional study with college students (Alloy et al. 2000) and one longitudinal study with adolescents (Abela et al. 2009) lend support for this moderation model, but two experimental studies (Ciesla and Roberts 2007 [second and third study reported]) and two longitudinal studies with college students did not find support this moderation model (Ciesla et al. 2011; Robinson and Alloy 2003[1]). Alloy et al. (2000) found that individuals with a combination of a composite of negative inferences about stability, globality, consequences, and the self and dysfunctional attitudes (Beck 1976) and a ruminative response style were more likely to have a history of major depression than individuals with only one or neither of these vulnerabilities. However, the use of both retrospective data and measuring cognitive risk as a combination of high levels of negative inferences and dysfunctional attitudes, a cognitive construct from Beck's theory (1976), were limitations of this study. Thus, it is possible that the significant effect of the interaction between cognitive risk and rumination in Alloy et al.'s (2000) study was not related to the negative inferences but instead to the dysfunctional attitudes.

Abela et al.' (2009) and Ciesla and Roberts' (2007) studies overcame both of these limitations. Abela et al. (2009) demonstrate that the main and interaction effects of rumination and negative inferences predict depressive symptoms. However, two laboratory studies (Ciesla and Roberts 2007 [second and third study reported]) and one longitudinal study (Ciesla et al. 2011) with college students did not find support for the attribution style (measured as a composite of negative inferences about internality, stability, and globality) and rumination (measured as composite of brooding and reflection) interaction. Thus, based on the limitations of the existing literature using composite scores it is unclear if either or both ruminative dimensions are moderators in the associations between individual negative inferences and depressive symptoms.

Mediation and Moderation Another possible integrated model involves including both the proposed mediation and moderation models (Alloy et al. 2000). In this combined integrated model, each negative inference influences rumination while also interacting with rumination to influence depressive symptoms (Fig. 1, bottom). This model is not only consistent with the theoretical considerations to integrate the hopelessness model (Abramson et al. 1989) with the response style theory (Nolen-Hoecksema et al. 1992), it is also consistent with empirical studies supporting both of the suggested integrated models (Abela et al. 2009; Alloy et al. 2000; Lo et al. 2008; Spasojević and Alloy 2001). Support for such combined integrated model would mean that individuals who have negative

inferences and ruminate are not only more likely to develop depressive symptoms compared to individuals who have only one or neither of these vulnerabilities (Alloy et al. 2000) but that the former individuals are also more likely to later ruminate more which than makes them even more vulnerable to develop depressive symptoms.

While no study has tested this combined model in an adolescent sample, Pössel and Winkeljohn Black (2017) compared the combined model, the two original models, and the above outlined mediation and moderation models in a 3-wave longitudinal study with college students.[2] The authors found the combined model to fit the data best, with brooding directly and indirectly predicting depressive symptoms, and reflection only indirectly predicting depressive symptoms via brooding. Further, consistent with the hopelessness model (Abramson et al. 1989), the individual inferences about consequences and the self, but not about internality, predicted depressive symptoms. However, inconsistent with the hopelessness model, inferences about stability and globality did not predict depressive symptoms. Summarized, Pössel and Winkeljohn Black's (2017) findings support the combined model and highlight the relevance of examining each of the rumination dimensions and the individual inferences separated, instead of as one construct as the most previous studies have done (Abela et al. 2009; Alloy et al. 2000; Ciesla and Roberts 2007; Ciesla et al. 2011; Lo et al. 2008; Robinson and Alloy 2003; Spasojević and Alloy 2001). These findings with an emerging adult sample clearly emphasize the need to examine these models in different age groups, particularly adolescents.

The Current Study

Lakdawalla et al. (2007) called for more research on the applicability of cognitive models originally developed for adults in adolescents. The current study follows this call by attempting to integrate negative inferences outlined in the hopelessness model (Abramson et al. 1989) with rumination as described in the response style theory (Nolen-Hoecksema et al. 1992) in adolescents. We hypothesized that, in an integrated model, brooding would be influenced by individual negative inferences and would interact with the individual negative inferences to predict depressive symptoms. However, based on the inconsistent literature described above about the association of reflection with depressive symptoms, we could not predict whether reflection would be influenced by individual negative inferences and whether it would interact with individual negative inferences to predict depressive symptoms as well. Further, we proposed that all individual negative inferences (stability, globality, consequences, & self)

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[1] Robinson and Alloy (2003) measured rumination as proposed in the response style theory and stress-reactive rumination. While the first did not predict depression the latter did predict depression in this study.

[2] The authors do not provide details about the associations in the mediation or moderation models. Thus, it does not add to the discussion about those models.
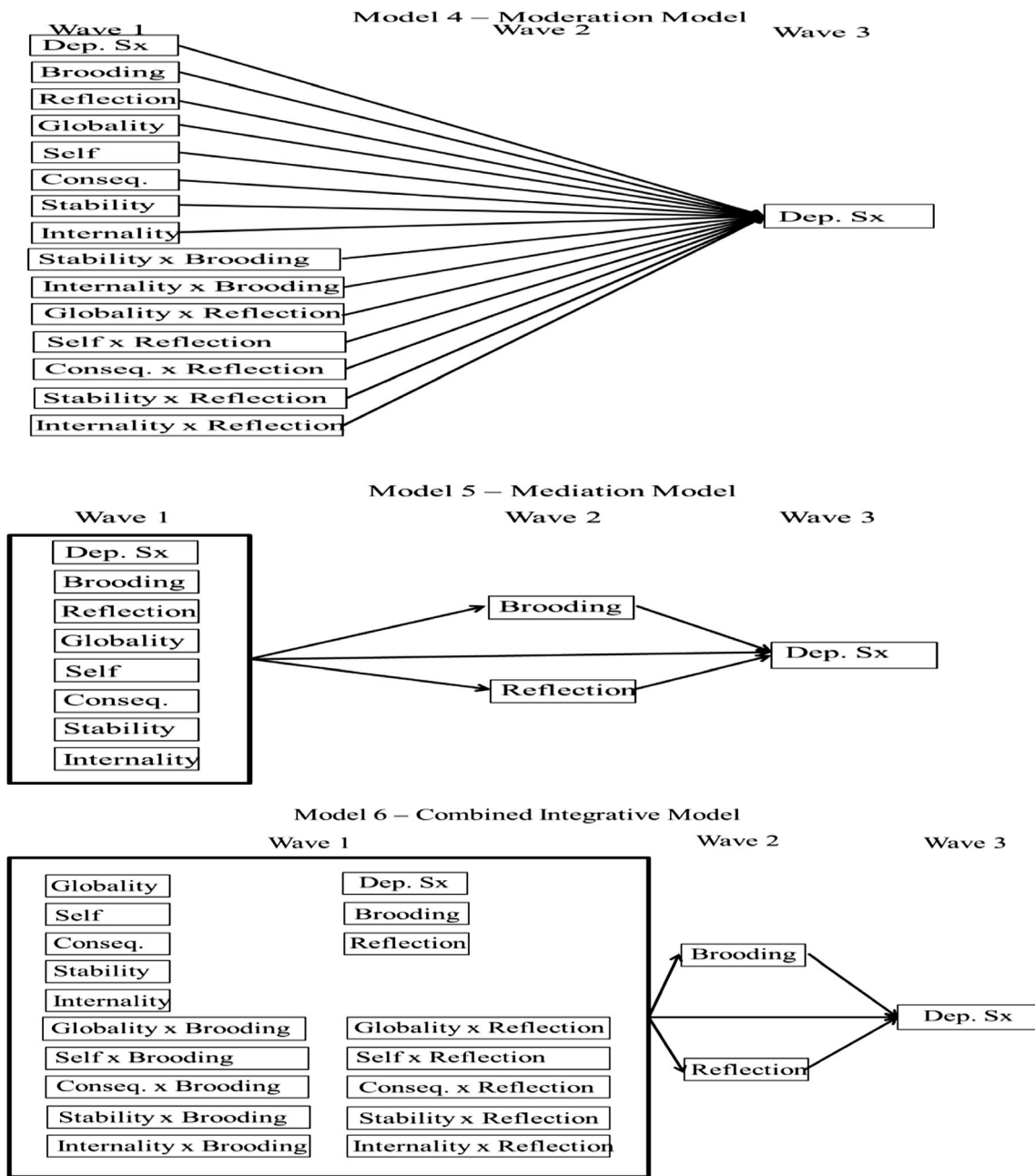
Fig. 1 Path diagram of Models 4 (moderation), 5 (mediation), and 6 (combined integrated). In the mediation and combined integrated models, all constructs in wave one have paths to constructs in waves two and three. For the sake of readability, this is represented by the three arrows coming from the thick box around the constructs at wave one

except for inferences about internality would influence rumination and interact with rumination to predict depressive symptoms.

Finally, we hypothesized that the associations found in an emerging adult sample would be replicated in adolescents. However, considering theories of developmental psychopathology (Cole and Turner Jr. 1993; Weiss and Garber 2003) and studies on the development of the adolescent brain (Mills et al. 2014) we cannot simply assume that findings with emerging adult samples can easily be generalized to adolescents. Thus, determining whether and how Pössel and Winkeljohn Black's (2017) findings can be replicated in adolescents will provide information about when the examined cognitive constructs emerge and interact with one another, which can inform preventions and interventions for adolescents.

Methods

Participants

Adolescents ($N = 519$; mean age$_{Wave\ 1} = 16.09$ years; $SD = 0.70$; 62.7% female) were recruited from freshmen classes at a Midwestern, partially suburban, public high school (total school population = 1700) in the United States. The sample was largely European American (72.7%; followed by 14.7% African American, 5.4% Latino, 4.4% mixed race/ethnicity, 1.4% Asian/Pacific Islander, 0.8% Native American, and 0.6% identified as "other"). The school serves predominantly working to middle class families, with almost one third of the students eligible for free or reduced price lunch programs. From the first to the third wave 37 adolescents (19 females) dropped out of the study. There were no differences between the dropouts and remaining adolescents in sex, $\chi^2(1) = 2.26$, $p = 0.133$, or race/ethnicity, $\chi^2(6) = 6.67$, $p = 0.352$. However, dropouts were significantly older, $t(60.0) = -4.44$, $p < 0.001$, and reported more depressive symptoms at t1 than the remaining adolescents, $t(497) = -2.59$, $p = 0.010$.

Measures

Center for Epidemiological Studies – Depression Scale (CES – D) The CES-D (Radloff [1977]) consists of 20 items (e.g., "During the past week, there were things that upset me that usually do not upset me.") and was developed to be as a quickly administered, economical screening instrument of self-reported depressive symptoms. Frequency of symptoms is rated on a four-point scale, with higher numbers indicating higher frequency of occurrence. Roberts et al. ([1991]) attained a high internal consistency using a large adolescent sample ($\alpha = 0.89$) and demonstrated sensitivity and specificity similar to the ones in adults.

Adolescent Cognitive Style Questionnaire (ACSQ) The ACSQ (Hankin and Abramson [2002]) measures inferences about causes, consequences, and the self in relation to negative events as described by Abramson et al. ([1989]). The ACSQ consists of 12 hypothetical event scenarios. Students were presented with a hypothetical event and asked to write down one cause for the event. Students then rated the degree to which the cause of the hypothetical event was (a) internal, (b) stable, and (c) global (negative inferences about the causes of negative events). Next, they rated the likelihood that further negative consequences would result from the event (negative inferences about consequences). Finally, they rated the degree to which the occurrence of the event meant that the self is flawed (negative inferences about the self). Each rating uses a 7-point Likert scale, with higher scores representing more

negative inferences. Hankin and Abramson attained high internal consistencies for the ACSQ scales ranging from $\alpha = 0.91$ to 0.93) and could support the construct validity of the ACSQ by significant correlations of the ACSQ scales with measures of attribution style and depressive symptoms in adolescents.

Response Styles Questionnaire (RSQ) The Rumination Response Subscale (RRS; Nolen-Hoeksema and Morrow [1991]) consists of 18 4-point Likert items that measure how often a participant engaged in various behaviors in response to depressed mood. Based on Treynor et al.'s ([2003]) factor analyses, the RRS was divided into the subscales *brooding* (e.g., "When I feel down, sad, or depressed, I think ,Why do I always react this way?") and *reflection*. (e.g., "When I feel down, sad, or depressed, I analyze recent events to try to understand why I am depressed."). Higher scores represent more engagement in ruminative behaviors. Ciesla et al. ([2011]) found internal consistencies for the brooding ($\alpha = 0.77$) and reflection ($\alpha = 0.67$) subscales in their adolescent sample similar to the ones identified in the current study. Further, the same study supported the construct validity of the RRS subscales in form of a significant correlation between depressive symptoms and the brooding but not the reflection subscale.

Procedures

Letters describing the study were sent to parents of students enrolled at the participating high school. Students for whom parental consent was received were invited to participate and asked for their assent. Assessments were conducted three times at 3-month intervals in group sessions during school hours. At wave 1, all individual negative inferences, both response styles (brooding and reflection), and depressive symptoms were measured. At wave 2, only brooding and reflection were measured, and at wave 3, depressive symptoms were measured. To be able to connect data from the different waves while maintaining confidentiality, the students developed their own code based on the initial of their first name, their last name, and their date of birth. The University of Louisville provided Institutional Review Board approval for our study.

Data Analysis

Full information maximum likelihood (FIML) - which estimates a likelihood function for each individual based on the variables that are present so that all the available data are used - was used, enabling the inclusion of participants with missing data to compensate for missing data related to attrition. FIML is a robust estimator even if data are not missing at random

(Collins et al. 2001; Graham 2003). This is of crucial importance for our study as participants that dropped out were older and reported more depressive symptoms than participants who remained in the study.

To test which model fit the data best, Cole and Maxwell's (2003) approach for multi-wave studies using structural equation modeling was used. The analyses were conducted with the maximum likelihood method using AMOS 21 to calculate structural equation models (Arbuckle 1999). Goodness of fit of the models was tested with χ^2. Statistically nonsignificant values of χ^2 indicate a good fit of the model to the data. However, as χ^2 is known to increase with sample size and degrees of freedom, the χ^2 was complemented by the root mean squared of the residuals (RMSEA; Steiger and Lind 1980), and Comparative Fit Index (CFI; Bentler 1990). A RMSEA value of 0.00 indicates a perfect model fit; a value of ≤0.05 is regarded as indicator of a good model fit; and a value of ≤0.08 is seen as acceptable (Hu and Bentler 1999). CFI values of ≥0.95 indicate a good model fit and values of ≥0.90 are regarded as acceptable (Hu and Bentler 1999).

We used ΔCFI and χ^2 difference tests to compare models. When ΔCFI of two models is >0.002 the model with higher CFI fits the data significantly better, when ΔCFI is ≤0.002 both models fit equally well and the more parsimonious model (more dfs) should be accepted (Meade et al. 2008). Further, nested models with the same number of observed variables are compared using χ^2 difference tests. When $\Delta\chi^2$ is significant for Δdf, the models are seen as significantly different from each other. To estimate if and how much an integration of the hopelessness model (Abramson et al. 1989) and the response style theory (Nolen-Hoecksema et al. 1992) increases the predictive value of the cognitive constructs of both theories, percentage of explained variance in depressive symptoms was calculated for each model.

To test for multiple mediators, 95% bootstrapping confidence intervals (CIs) were calculated using the bias-corrected percentile method (Preacher and Hayes 2008). Based on this approach, multiple mediation effects exist when the indirect effect (i.e., the effect from independent variable through all possible mediators to the dependent variable) is significant. As this procedure tests only for multiple mediation effects, 95% confidence intervals (CIs) for possible individual mediation effects with brooding and reflection were calculated for all associations with significant indirect effects using RMediation (Tofighi and MacKinnon 2011). A significant individual mediation effect exists when the confidence interval does not contain zero. The results regarding mediation effects were interpreted using Zhao et al.'s (2010) rules regarding types of mediation and non-mediation.

All analyses were calculated using both the full CES-D and only the CES-D items that measure hopelessness depression (excluded items: 4, 10, 15, 16, 18, & 19). As both analyses

revealed the same pattern of results, only the findings with the full CES-D are presented here.

Results

Descriptive data, internal consistencies, and correlations for all instruments are presented in Table 1. The majority of the measures correlated with each other.

Determination of the Best Fitting Model

Description of Model Fit To identify the best fitting model, six different models were tested and compared. The influence of depressive symptoms at wave 1 was controlled for in all six models. These models can be understood as two sets of models including three models each. The first set of models includes the two original models: Model 1 represented the original hopelessness model (Abramson et al. 1989), without brooding and reflection or their interactions with the individual negative inferences (χ^2 (1) = 2.143, p = 0.143, CFI (0.999), RMSEA (0.047), explained variance in depressive symptoms: 30.8%). Model 2 described the response style theory (Nolen-Hoecksema et al. 1992) without negative inferences from the hopelessness model (χ^2 (1) = 2.648, p = 0.104, CFI (0.997), RMSEA (0.056), explained variance: 28.9%). Model 3 allowed for direct associations between each individual negative inference and both response styles (brooding and reflection) measured at wave 1 and depressive symptoms measured at wave 3 but did not allow for associations between the response style and constructs of the hopelessness model (χ^2 (12) = 87.258, p = 0.001, CFI (0.965), RMSEA (0.110), explained variance: 28.5%).

The other set of models describes different integrated hopelessness-rumination models. Model 4 was based on Alloy et al. (2000) and Ciesla and Roberts' (2007) moderation model. This model includes the individual negative inferences, brooding and reflection, and the interaction of each of the negative inferences with brooding and reflection at wave 1 as predictors of depressive symptoms at wave 3 (Fig. 1, top; χ^2 (3) = 3.631, p = 0.304, CFI (1.000), RMSEA (0.020), explained variance: 34.6%). Model 5 follows the proposal that rumination mediates the association between negative inferences and depressive symptoms. In other words, Model 5 includes the individual negative inferences at wave 1 and both response styles at wave 1 and 2. Further, the negative inferences are directly and indirectly through the response styles associated with depressive symptoms at wave 3 (Fig. 1, middle; χ^2 (4) = 41.998, p = 0.001, CFI (0.982), RMSEA (0.135), explained variance: 34.0%). Finally Model 6 (Fig. 1, bottom) represented the combination the mediation and the moderation model. In this model the individual negative inferences, brooding and reflection, and the interactions between the

Table 1 Descriptive data, internal consistencies, and correlations between all instruments ($N \geq 435$)

	CES-Dt1	CES-Dt3	CSQit1	CSQgt1	CSQst1	CSQcot1	CSQset1	RSQbt1	RSQrt1	RSQbt2	RSQrt2
CES-Dt1	0.89										
CES-Dt3	0.51**	0.92									
CSQit1	−0.04	0.09*	0.94								
CSQgt1	0.37**	0.31**	0.19**	0.92							
CSQst1	0.32**	0.25**	0.34**	0.63**	0.93						
CSQcot1	0.35**	0.36**	0.27**	0.81**	0.57**	0.92					
CSQset1	0.36**	0.39**	0.34**	0.73**	0.54**	0.84**	0.93				
RSQbt1	0.51**	0.41**	0.20**	0.29**	0.27**	0.31**	0.35**	0.70			
RSQrt1	0.42**	0.25**	0.03	0.23**	0.15**	0.22**	0.27**	0.63**	0.75		
RSQbt2	0.34**	0.42**	0.17**	0.22**	0.20**	0.25**	0.30**	0.57**	0.36**	0.69	
RSQrt2	0.28**	0.37**	0.14**	0.17**	0.07	0.21**	0.27**	0.44**	0.38**	0.65**	0.73
Mean	18.80	15.55	39.63	34.93	41.46	31.21	29.58	2.16	2.11	2.10	2.05
SD	11.22	11.54	20.50	16.12	17.77	15.46	15.99	0.75	0.67	0.74	0.67

Values in the diagonal represent Cronbach's Alpha

CES-D = Center for Epidemiological Studies – Depression; CSQi = CSQ, negative events internal-external; CSQg = CSQ, negative events general-specific; CSQs = CSQ, stable-unstable; CSQco = CSQ, negative inference about consequences; CSQse = CSQ, negative inference about the self; RSQb = Response Style Questionnaire, brooding; RSQr = Response Style Questionnaire, reflection; t1 = assessment wave 1; t2 = assessment wave 2; t3 = assessment wave 3

$* p < 0.05$; $** p < 0.01$

negative inferences and the response styles at wave 1 are directly and through brooding and reflection at wave 2 associated with depressive symptoms at wave 3 (χ^2 (6) = 9.948, p = 0.127, CFI (0.999), RMSEA (0.036), explained variance: 37.6%). The goodness of fit indices of all models except the Model 3 and Model 5 were good. The χ^2-values of these two models were significant and the RMSEAs were unacceptable while the CFIs of both models were good.

Comparison of Model Fit The model fit statistics and variance explained in the above models were compared in order to determine the best-fitting model to the data. First, Models 1–3 (no integrations) were compared with each other. The comparison of the original hopelessness model (Model 1) and the original response style theory (Model 2) with Model 3 demonstrated significant differences between the models (Model 1 vs. Model 3: ΔCFI = 0.034; $\Delta\chi^2$ (11, N = 519) = 85.115, $p <$ 0.001; Model 2 vs. Model 3: ΔCFI = 0.032; $\Delta\chi^2$ (11, N = 519) = 84.610, $p < 0.001$), favoring Models 1 and 2, which were retained. Second, Models 1 and 2 were compared to the moderation model (Model 4). The comparison of the Models 1 and 2 with Model 4 favored Model 4 (Model 1 vs. Model 4: ΔCFI = 0.001; $\Delta\chi^2$ (2, N = 519) = 1.488, p = 0.475; Model 2 vs. Model 4: ΔCFI = 0.003; $\Delta\chi^2$ (2, N = 519) = 0.983, p = 0.612). Thus, Model 4 (moderation model) was retained. Third, the comparison of the Models 1 and 2 with the mediation model (Model 5) revealed significant differences (Model 1 vs. Model 5: ΔCFI = 0.017; $\Delta\chi^2$ (3, N = 519) = 39.855, $p <$ 0.001; Model 2 vs. Model 5: ΔCFI = 0.015; $\Delta\chi^2$ (3, N =

519) = 39.350, $p < 0.001$). Thus, Models 1 and 2 were retained as they had better model fit than model 5.

Finally, the original hopelessness model (Model 1), the original response style theory (Model 2), and the moderation model (Model 4) were compared with the combined model (Model 6). These comparisons revealed nonsignificant differences (Model 1 vs. Model 6: ΔCFI = 0.000; $\Delta\chi^2$ (5, N = 519) = 7.805, p = 0.167; Model 2 vs. Model 6: ΔCFI = 0.002; $\Delta\chi^2$ (5, N = 519) = 7.300, p = 0.199; Model 4 vs. Model 6: ΔCFI = 0.001; $\Delta\chi^2$ (3, N = 519) = 6.317, p = 0.097), preferring Model 6. Thus, although both the combined integrated model and the moderation model indicated good fit to the data, the combined integrated model (Model 6; Fig. 1, bottom) was retained as it had more dfs and was therefore more parsimonious. The integrated model explained 6.8% more variance than the original hopelessness model, 8.7% more variance than the original response style theory model, and 3% more variance than the moderation model.

Analyses of Individual Associations of the Best-Fitting Model

Multiple and individual mediations were calculated using Preacher and Hayes' (2008) and Tofighi and MacKinnon's (2011) approaches, respectively. Multiple mediation analyses (Table 2) revealed a marginally significant direct effect and no indirect effect of reflection measured at wave 1 on depressive symptoms measured at wave 3. Thus, no mediation effect existed for this association (Zhao et al. 2010).

Table 2 Total, direct, and indirect effects and their confidence intervals testing for multiple mediations

	Effects	Lower CL	Upper CL
Total effects			
CSQit1 – CES-Dt3	0.021	−0.016	0.054
CSQgt1 – CES-Dt3	−0.047	−0.137	0.017
CSQst1– CES-Dt3	−0.017	−0.068	0.032
CSQcot1 – CES-Dt3	0.069	−0.018	0.195
CSQset1 – CES-Dt3	0.108*	0.030	0.212
RSQbt1 – CES-Dt3	2.538*	1.332	3.795
RSQrt1 – CES-Dt3	−1.149	−2.387	0.181
CSQit1 by RSQbt1 – CES-Dt3	−0.461	−1.639	0.241
CSQgt1 by RSQbt1 – CES-Dt3	0.466	−0.935	1.983
CSQst1 by RSQbt1 – CES-Dt3	1.724*	0.388	2.943
CSQcot1 by RSQbt1 – CES-Dt3	−1.209	−3.574	0.278
CSQset1 by RSQbt1 – CES-Dt3	−0.211	−1.664	1.075
CSQit1 by RSQrt1 – CES-Dt3	0.449	−0.354	1.578
CSQgt1 by RSQrt1 – CES-Dt3	−0.768	−2.520	0.517
CSQst1 by RSQrt1 – CES-Dt3	−0.717	−2.012	0.536
CSQcot1 by RSQrt1 – CES-Dt3	0.483	−1.517	2.488
CSQset1 by RSQrt1 – CES-Dt3	0.490	−1.243	2.425
Direct effects			
CSQit1 – CES-Dt3	0.015	−0.021	0.052
CSQgt1 – CES-Dt3	−0.036	−0.121	0.024
CSQst1– CES-Dt3	−0.009	−0.054	0.042
CSQcot1 – CES-Dt3	0.059	−0.032	0.165
CSQset1 – CES-Dt3	0.081+	0.000	0.186
RSQbt1 – CES-Dt3	1.186+	0.001	2.586
RSQrt1 – CES-Dt3	−1.491+	−2.495	−0.223
CSQit1 by RSQbt1 – CES-Dt3	−0.356	−1.335	0.353
CSQgt1 by RSQbt1 – CES-Dt3	−0.110	−1.675	1.240
CSQst1 by RSQbt1 – CES-Dt3	1.451+	0.104	2.663
CSQcot1 by RSQbt1 – CES-Dt3	−0.495	−2.246	0.950
CSQset1 by RSQbt1 – CES-Dt3	−0.167	−1.588	1.042
CSQit1 by RSQrt1 – CES-Dt3	0.205	−0.557	1.304
CSQgt1 by RSQrt1 – CES-Dt3	−0.320	−1.950	0.885
CSQst1 by RSQrt1 – CES-Dt3	−0.543	−1.724	0.667
CSQcot1 by RSQrt1 – CES-Dt3	−0.020	−1.741	1.938
CSQset1 by RSQrt1 – CES-Dt3	0.633	−1.111	2.519
Indirect effects			
CSQit1 – CES-Dt3	0.006	−0.003	0.017
CSQgt1 – CES-Dt3	−0.011	−0.037	0.002
CSQst1– CES-Dt3	−0.008	−0.022	0.004
CSQcot1 – CES-Dt3	0.011	−0.012	0.035
CSQset1 – CES-Dt3	0.027*	0.011	0.060
RSQbt1 – CES-Dt3	1.352*	0.665	2.013
RSQrt1 – CES-Dt3	0.342	−0.026	0.814
CSQit1 by RSQbt1 – CES-Dt3	−0.105	−0.328	0.109
CSQgt1 by RSQbt1 – CES-Dt3	0.576*	0.223	1.092
CSQst1 by RSQbt1 – CES-Dt3	0.273+	0.007	0.598
CSQcot1 by RSQbt1 – CES-Dt3	−0.715*	−1.413	−0.220

Table 2 (continued)

	Effects	Lower CL	Upper CL
CSQset1 by RSQbt1 – CES-Dt3	−0.044	−0.373	0.225
CSQit1 by RSQrt1 – CES-Dt3	0.243*	0.065	0.549
CSQgt1 by RSQrt1 – CES-Dt3	−0.448*	−0.942	−0.117
CSQst1 by RSQrt1 – CES-Dt3	−0.175	−0.429	0.085
CSQcot1 by RSQrt1 – CES-Dt3	0.502+	0.108	1.225
CSQset1 by RSQrt1 – CES-Dt3	−0.143	−0.661	0.208

CL = Confidence limit; CES-D = Center for Epidemiological Studies – Depression; CSQi = CSQ, negative events internal-external; CSQg = CSQ, negative events general-specific; CSQs = CSQ, stable-unstable; CSQco = CSQ, negative inference about consequences; CSQse = CSQ, negative inference about the self; RSQb = Response Style Questionnaire, brooding; RSQr = Response Style Questionnaire, reflection; t1 = assessment wave 1; t2 = assessment wave 2; t3 = assessment wave 3

$+ p < 0.10$; $* p < 0.05$

Marginally significant direct and significant indirect effects of inferences about characteristics of the self and brooding at wave 1 on depressive symptoms at wave 3 were found in the multiple mediation analyses (Table 2). Neither brooding (95% CI: -0.003 – 0.034) nor reflection at wave 2 (95% CI: 0.000– 0.041) mediated the association between inferences about characteristics of the self at wave 1 and depressive symptoms at wave 3, but brooding (95% CI: 0.202–1.650) and reflection at wave 2 (95% CI: 0.077–0.906) mediated the association between brooding at wave 1 and depressive symptoms at wave 3. Thus, the association between inferences about characteristics of the self at wave 1 and depressive symptoms at wave 3 was not mediated by brooding or reflection at wave 2, while both partially mediated the association between brooding at wave 1 with depressive symptoms at wave 3 (Zhao et al. 2010).

Multiple mediation analyses revealed marginally significant direct and indirect effects of the stability inferences by brooding interaction at wave 1 on depressive symptoms at wave 3 (Table 2) and brooding (95% CI: 0.028–0.579), but not reflection at wave 2 (95% CI: -0.179 – 0.228), mediated this association. No further significant or marginally significant direct effect of inference by response style interactions at wave 1 on depressive symptoms at wave 3 (Table 2). However, a significant indirect effect of the globality inference by brooding interaction at wave 1 on depressive symptoms at wave 3 and a marginally significant indirect effect of the consequences inference by reflection interactions at wave 1 on depressive symptoms at wave 3 were found (Table 2). Brooding (95% CI: 0.029–0.72) and reflection at wave 2 (95% CI: 0.008–0.658) mediated the association between the globality inference by brooding interaction at wave 1 and depressive symptoms at wave 3. Further, brooding (95% CI: -1.085 – -0.081), but not reflection at wave 2 (95% CI: -

0.645 – 0.075) mediated the association between the consequences inference by brooding interaction at wave 1 and depressive symptoms at wave 3.

Similarly, the associations of the internality inference by reflection interaction (Brooding at wave 2: 95% CI: 0.014–0.403; reflection at wave 2: 95% CI: -0.057 – 0.254) and the consequences inference by reflection interaction (Brooding at wave 2: 95% CI: 0.005–0.859; reflection at wave 2: 95% CI: -0.152 – 0.566) at wave 1 with depressive symptoms at wave 3 were mediated by brooding, but not reflection. Finally, reflection (95% CI: -0.653 – -0.004), but not brooding at wave 2 (95% CI: -0.543 – 0.059) mediated the association between the global inference by reflection interaction at wave 1 and depressive symptoms at wave 3. Summarized, all five of the six associations presented in this paragraph were fully mediated by ruminative dimensions measured at wave 2 (Zhao et al. 2010). Of those five associations, only one association was mediated by brooding and reflection (globality inference by brooding interaction) and only one by reflection only (global inference by reflection interaction). Three associations (consequences inference by brooding interaction, internality inference by reflection interaction, and consequences inference by reflection interaction) were mediated by brooding and not by reflection at wave 2. Finally, brooding partially mediated the association between stability inferences by brooding interaction at wave 1 and depressive symptoms at wave 3.

Discussion

A significant amount of research has been done on cognitive models of depression in both emerging adults and adolescents. Less work has been done to determine how variables proposed in these models may interact, in addition to the lack of work exploring whether these interactions may heighten depressive symptoms more than one model alone. While some of these interactions have been explored in emerging adults (e.g., Pössel and Winkeljohn Black 2017), how these cognitive models to depression integrate in adolescents is largely unknown. Our study sought to determine whether and how the hopelessness model (Abramson et al. 1989) and the response style theory (Nolen-Hoeksema and Morrow 1991) might be integrated to explain depressive symptoms in adolescents, a developmental time of critical importance for cognitive development (Cole and Turner Jr. 1993; Weiss and Garber 2003) and during which depressive symptoms become more prevalent (Kessler et al. 2012). We analyzed and compared several integrated models of cognitive vulnerabilities of depression. Consistent with the theoretical considerations of integrating the hopelessness model (Abramson et al. 1989) with the response style theory (Nolen-Hoecksema et al. 1992) and previous empirical studies in emerging adults (Abela et al. 2009; Alloy et al. 2000; Lo et al. 2008; Pössel and Winkeljohn Black

2017; Spasojević and Alloy 2001), we found the combined integrated model fits the data better than the original cognitive models and the other integrated models. Based on our finding, it is clear that the cognitive constructs proposed in the hopelessness model and response style theory are intertwined in their impact on depressive symptoms.

While the inspection of the associations in this model revealed important similarities between our hypotheses and a previous study with emerging adults (Pössel and Winkeljohn Black 2017), it also showed differences. For example, we found significant or marginally significant associations between the main or interaction effects of all individual negative inferences (internality, stability, globality, consequences, characteristics of the self) and depressive symptoms six months later. Consistent with the hopelessness model (Abramson et al. 1989), we expected this for all individual negative inferences except for negative inferences about internality. Further, brooding *and* reflection played an important role in our integrated model. Both ruminative styles at wave 1 directly influenced depressive symptoms at wave 3 and interacted with negative inferences about globality and consequences in predicting depressive symptoms. In addition, brooding interacted with negative inferences about stability and reflection interacted with negative inferences about internality in predicting depressive symptoms six months later. Finally, as we predicted, brooding at wave 2 mediated, at least partially, the association of brooding at wave 1 and the main and interaction effects of all individual negative inferences with the exception of negative inferences about internality at wave 1 with depressive symptoms at wave 3. This was as we predicted because Abramson et al. (1989) proposed that negative inferences about internality do not predict depressive symptoms. Contrary to our hypotheses and findings with emerging adults, reflection at wave 2 also mediated the associations of brooding and the negative inferences about globality by brooding and by reflection interactions at wave 1 with depressive symptoms at wave 3.

Summarized, all of our findings that were contrary to our predictions or findings using the same integrated model in emerging adults (Pössel and Winkeljohn Black 2017) involve reflection. This raises the question of why reflection seems more important in the combined integrated model for adolescents than for emerging adults (Pössel and Winkeljohn Black 2017). An interesting difference in the correlation patterns of both ruminative styles between the studies with emerging adults and adolescents may provide a clue. In studies with adults and emerging adults, each ruminative style correlated higher with itself across different waves than with the other ruminative style at the same wave (Pössel and Winkeljohn Black 2017; Treynor et al. 2003). In our study with adolescents and another study with adolescents of similar age (age 13 to 15 years; $M = 13.58$; $SD = 0.56$; Winkeljohn Black and Pössel 2013), however, both ruminative styles at the same

wave correlate higher with each than the same ruminative style across different waves. In other words, in adults and emerging adults brooding and reflection appear to be related but clearly distinguishable constructs; this may have not been the case in our study with adolescents. Thus, it might be reflection appears more important than predicted because brooding and reflection are not as separated in adolescents than in adults and emerging adults.

However, contrary to this developmental explanation, brooding and reflection loaded onto separated factors in a sample of even younger participants than in our study (age 10 to 12 years; $M = 10.9$; $SD = 0.62$; Verstraeten et al. 2010). In addition, not only did some previous studies with adolescents (Mezulis et al. 2011) and adult populations (Treynor et al. 2003) find associations between reflection and depressive symptoms, but other studies with adolescents (Verstraeten et al. 2010; Winkeljohn Black and Pössel 2013, 2015) and emerging adults (Lo et al. 2008) did not find such associations. Thus, while differences in the age of participants seem not to explain all of the differences in associations among cognitive variables and depressive symptoms between adults and adolescents, more studies are needed to test the influence of development on these differences. One way to test for the impact of development, as well as attempt to replicate the current findings, would be to include multiple age groups in a single study. Considering theories of developmental psychopathology (Cole and Turner Jr. 1993; Weiss and Garber 2003) and cortical restructuring (Mills et al. 2014), participants from early adolescence to early adulthood (age groups from 12 to 22 years) should be included in such a study.

As age does not seem to explain all contrary findings, directly measuring cognitive development may be a better approach to consider the developmental hypotheses when studying associations among cognitive variables and depressive symptoms. This approach was successful in a study with 8 to 16 year old youth (Weitlauf & Cole, 2012). These authors found that the amount of variance in depressive symptoms that inference styles explained depended on the participant's level of cognitive development. Further, only when controlling for cognitive development could Weitlauf and Cole (2012) confirm the hopelessness model in younger participants. Thus, measuring and controlling for cognitive development might be a beneficial strategy in future studies attempting to build evidence for the integration of different cognitive models of depression in adolescents.

Strengths and Limitations

Our study is the first to research the associations between individual negative inference styles and brooding and reflection in adolescents instead of using composites of multiple negative inference styles and the combined ruminative style. While a relatively large sample size can be seen as another strength of our study, this sample size is still relatively small considering the complexity of the combined integrated model. This consideration is reflected by (a) some significant paths being close to zero which demonstrates they have relatively small effect sizes and (b) some confidence intervals being wide which is a sign of limited power. While there is no way to precisely calculate the necessary sample size and the suggested minimum sample size for structural equational modeling of models is 200 participants, recent recommendations suggest to include 10 participants per estimated variables (Kline 2015). However, the results of the study should be interpreted with the wide confidence intervals and small effect sizes in mind. In addition, future studies should attempt to include even more adolescents in a longitudinal study further examining the integrated model in order to address potential issues with power. It is important that future studies attempt to replicate the current findings in order to confirm the existence of the effects found in the current study. However, it should be noted that the integrated model, although it had some relations that may have been underpowered, still had a better fit to the data and explained the most variance in depressive symptoms, even compared to models estimating fewer variables.

The sole use of self-report instruments is another limitation of the present study for two reasons. First, a mono-method bias from using the same informant and method for assessing all constructs in our study was possible. Second, the use of self-report instruments to measure negative inference styles and ruminative styles may be criticized because it is questionable how much insight individuals really have into their own style of thinking (see Scher et al. 2005, for a review). Therefore, information processing paradigms might be better suited than self-report questionnaires when measuring process constructs. Thus, future studies would benefit from the use of multiple methods (e.g., self-report questionnaires, interview data to measure depressive symptoms, and information processing paradigms) to assess cognitive constructs and depressive symptoms. Nevertheless, information processing paradigms have not been developed for either of the measured cognitive constructs in the present study (Gotlib and Neubauer 2000), while self-report instruments are readily available for all of these constructs. Therefore, we decided to use these well-established instruments in our studies.

Further, both the hopelessness model (Abramson et al. 1989) and the response style theory (Nolen-Hoecksema et al. 1992) are vulnerability-stress models. Thus, the vulnerabilities need to be activated by stressors (e.g., life events and/or daily hassles) in order to impact depressive symptoms. As stress was not included in our study, it is possible that the associations of cognitive variables with depressive symptoms were underestimated. However, the statistical significance of predicted associations in our study seems to point to the limited impact of the failure to include stress. Nevertheless, future research integrating different cognitive theories should focus

on highly stressed individuals (e.g., bereaving adolescents, individuals with a history of childhood abuse and neglect, adolescents transitioning from middle to high-school) and include measures of various stressors.

Last, it is important to acknowledge the differences in age and depressive symptoms in participants who dropped out of the study over the course of the three waves of data collection. Participants who dropped out were found to be both statistically significantly older and report statistically significantly more depressive symptoms as participants who did not drop out of the study, and thus were retained and represented in the analyses.

Conclusions

In summary, our results are not only significant from an academic point of view, but are also significant for clinical applications. We replicated and extended earlier findings providing evidence that the hopelessness model (Abramson et al. 1989) and the response style theory (Nolen-Hoecksema et al. 1992) can be integrated in adolescents into one model in which ruminative styles are influenced by individual negative inferences and interact with individual negative inferences to predict depressive symptoms. This combined integrated model may provide a theoretical framework to comprehend how therapeutic techniques from one cognitive model influences cognitive constructs from a different model. By doing so our findings may make cognitive psychotherapies for depressive symptoms more effective, as therapists can integrate techniques based on either of the two original models in one theory-driven treatment approach. However, first the role of reflection in the combined integrated model needs to be clarified, particularly across different developmental levels.

Compliance with Ethical Standards

Conflict of Interest   The authors declare that they have no conflict of interest.

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

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

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