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COGNITIVE/AFFECTIVE INFLUENCES ON RUMINATIVE SUBTYPES, SOCIAL
PROBLEM-SOLVING STYLES, AND SUICIDAL IDEATION

A dissertation submitted in partial fulfillment

of the requirements for the degree of

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by

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ABSTRACT

COGNITIVE/AFFECTIVE INFLUENCES ON RUMINATIVE SUBTYPES, SOCIAL PROBLEM-SOLVING STYLES, AND SUICIDAL IDEATION

Robert Lane

Emerging adulthood is a developmental period from 18 to 29 years of age associated with elevated levels of suicidal thoughts and planning, and suicide risk. The present study examined whether cognitive inflexibility interacts with high levels of emotion reactivity (i.e., A tendency to experience strong negative affect in response to stress) and brooding (i.e., A repetitive form of emotion driven thinking associated with depressive symptoms) to predict suicidal ideation via a relation mediated by avoidant problem-solving (i.e., A problem-solving style characterized by avoiding aspects of a social problem including negative emotions). It also examined whether cognitive inflexibility interacts with low levels of emotion reactivity and reflection (i.e., A repetitive form of problem-oriented thinking focused on resolving depressive symptoms) to predict suicidal ideation via a relation mediated by planful problem-solving at low levels of cognitive inflexibility, and impulsive problem-solving at high levels of cognitive inflexibility.

A racially/ethnically diverse sample of emerging adult college undergraduate students ($N = 162$; 75% female), ages 18 to 29 ($M = 19.36$, $SD = 1.61$) were recruited from an urban private university in New York City, via an online psychology department participant recruitment system. During in-person appointments, participants completed the Wisconsin Card Sorting Test, the Beck Depression Inventory, the Beck Hopelessness

Scale, the Ruminative Response Scale, the Social Problem-Solving Inventory Revised (short version), the Emotion Reactivity Scale, and the Suicidal Behaviors Questionnaire – Revised. Participants were assessed for suicide risk, debriefed, and compensated with their choice of 10 dollars or 1 credit toward research participation.

Path analyses conducted using the *lavaan* package for R tested four progressive models, the fourth of which modeled study hypotheses. Study hypotheses were mostly unsupported, and all path models were poor fits to the data. Thus, the results should be interpreted with caution. Brooding significantly predicted avoidant problem-solving and reflection significantly predicted planful problem-solving after controlling for depressive symptoms and hopelessness.

These findings, and prior research, suggest reflection might be less deleterious than brooding. It may be best to discourage rumination among patients, but if it is unavoidable, then reflection that is structured to be planful may be less harmful than brooding.

ACKNOWLEDGEMENTS

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

In 2016 approximately 45,000 individuals in the United States (US) died by suicide (Centers for Disease Control and Prevention, 2017), following an increase from 1999 to 2016 in the rates of suicide that spanned 49 of the 50 states (Centers for Disease Control and Prevention, 2018). Emerging adulthood, a developmental period that spans 18 to 29 years of age, is often associated with increased autonomy from parental authority, discrete identity exploration, and a transition into the workforce (Arnett, Žukauskienė, & Sugimura, 2014). However, it is also a period of heightened risk for suicide, with suicide being the second leading cause of death among individuals 15 to 24 years of age (Centers for Disease Control and Prevention, 2015b). In 2013, more adults from ages 18 to 25 reported having serious thoughts about suicide and creating suicide plans than adults in any other age group (Substance Abuse and Mental Health Services Administration, 2014).

Prior research has indicated that elevated levels of emotion dysregulation also occur during emerging adulthood compared to later developmental periods, and it is suggested that these elevated levels may be explained by an increased level of stress related to developmental challenges and transitions compared to older peers (Zimmermann & Iwanski, 2014). Other research also reports that emerging adults may employ less adaptive strategies for addressing emotion dysregulation compared to older peers (John & Gross, 2004). Such a pattern among emerging adults might be explained by less practice with emotion regulation strategies, compared to older individuals, due to less overall life experience. However, this pattern has also been linked to ongoing brain development during emerging adulthood that strengthens prefrontal regulation of the

brain's limbic system (Taber-Thomas & Perez-Edgar, 2016). For these reasons emerging adulthood might be a developmental period characterized by challenges in emotion regulation compared to later developmental periods.

Despite suicide being a burgeoning public health problem among all groups, including emerging adults, and our knowledge that increased risk for emotion dysregulation occurs during emerging adulthood, significant gaps remain in our understanding of the cognitive and affective factors that explain suicidal thoughts and behaviors. The proposed study seeks to elucidate potential relationships between these factors among emerging adults.

Depressive Rumination

One such factor is depressive rumination, which is a repetitive focus on negative cognitive and affective states associated with depressive symptoms with a particular emphasis on associated causes, consequences, and circumstances regarding these states (Nolen-Hoeksema & Morrow, 1991). Past research indicates that depressive rumination is significantly positively associated with suicidal ideation (Morrison & O'Connor, 2008a; Rogers & Joiner, 2017). Furthermore, depressive rumination has been implicated in multivariate studies that predict suicidal thoughts and behaviors. For example, in one study, depressive rumination moderated separate relationships between stress and hopelessness and suicidal ideation among Scottish adults (Morrison & O'Connor, 2008b). In other research, depressive rumination mediated relations between lifetime suicide attempts at baseline and suicidal ideation at follow up (Krajniak, Miranda, & Wheeler, 2013), emotion regulation strategies and suicidal ideation (Miranda, Tsypes, Gallagher, & Rajappa, 2013), emotion regulation and suicidal risk (Weis, Rothenberg, Moshe, Brent,

& Hamdan, 2015), and sleep problems and suicidal risk (Weis et al., 2015). Depressive

rumination has also been reported to predict suicidal ideation indirectly when mediated

by perceptions of entrapment (Teismann & Forkmann, 2017).

Prior research, has also examined the effects of specific dimensions of depressive

rumination on suicidal thoughts and behaviors. These ruminative subtypes include

brooding and reflection.

Brooding

Brooding is defined as a mood-directed repetitive analysis of causes, symptoms,

and consequences related to depressed states (Treynor, Gonzalez, & Nolen-Hoeksema,

2003). Brooding has widely been reported to have a deleterious association with suicidal

ideation and suicide risk. For example, a study that recruited British university students

found that brooding significantly predicted suicidal ideation both directly and indirectly

through a relation mediated by self-criticism (O'Connor & Noyce, 2008). Holdaway,

Luebbe, and Becker (2018) also reported that brooding was significantly positively

associated with suicidal ideation. Additional research that recruited university students in

the US reported that brooding predicted suicidal ideation directly and indirectly through a

relation mediated by depressive symptoms (Chan, Miranda, & Surrence, 2009). Morever,

stress-related symptoms predicted suicidal ideation via pathways mediated by brooding

alone and by brooding followed by depressive symptoms (Polanco-Roman, Gomez,

Miranda, & Jeglic, 2016). Elevated levels of brooding have also been observed among

children of depressed mothers who had experienced suicidal ideation relative to their

peers (Tsypes & Gibb, 2016). Brooding has also been reported to be indirectly related to

suicidal ideation via gratitude, and to interact with grit, a construct that is a form of

mental perseverance, to predict suicidal ideation at low levels of grit (White et al., 2017). In addition, prior research reports separate relations between brooding and suicide risk were mediated by premeditation and lack of perseverance (Two of four impulsivity dimensions measured in the study; see Valderrama, Miranda, & Jeglic, 2016).

Brooding has also been reported to be significantly positively related to suicide attempts in a recent meta-analysis of suicidal thoughts and behaviors (Rogers & Joiner, 2017) and by additional research among college students (Holdaway et al., 2018), and psychiatric inpatients (Grassia & Gibb, 2009). Other research has indicated that brooding mediated a relation between previously having made a suicide attempt and current depressed mood in a community sample of participants (Cameron, Brown, Dritschel, Power, & Cook, 2017). In addition, among psychiatric outpatients, agitation and nightmares, two dimensions of emotional over-arousal, each mediated relationships between brooding and both suicidal thoughts and behaviors (Rogers et al., 2017).

In summary, prior research indicates that brooding both directly (Chan et al., 2009; Grassia & Gibb, 2009; Holdaway et al., 2018; O'Connor & Noyce, 2008; Rogers & Joiner, 2017) and indirectly through a variety of mediators (i.e., depressive symptoms, Chan et al., 2009; self-criticism, O'Connor & Noyce, 2008; stress both alone and with depressive symptoms, Polanco-Roman et al., 2016; agitation and nightmares, Rogers et al., 2017; and impulsivity, Valderrama et al., 2016) maladaptively influences suicidal ideation. Some prior research suggests that arousal might exacerbate the tendency to brood and, in turn, influence suicidal thoughts and behaviors (Polanco-Roman et al., 2016; Rogers et al., 2017), but research examining the influence of cognitive factors in increasing arousal and brooding is incomplete and requires further inquiry.

Reflection

      Reflective rumination or reflection has been defined as a repetitive pondering focused upon problem-solving to alleviate a depressed state. Reflection has been reported to be associated with an emphasis on analyzing and overcoming problems and difficulties (Treynor et al., 2003). The relationship of reflection with suicidal thoughts and behaviors in prior research has lacked the consistency of that of brooding and suicidal thoughts and behaviors. Some studies have reported correlations between reflection and suicidal ideation but did not find other more dispositive kinds of significant statistical relationships (Chan et al., 2009; O'Connor & Noyce, 2008; White et al., 2017). Grassia and Gibb (2009) reported a significant relationship between reflection and suicidal ideation, but one that was weaker in strength than the relationship between brooding and suicidal ideation. Crane, Barnhofer, and Williams (2007) further reported that participants who endorsed prior suicidal thoughts and behaviors also endorsed lower mean levels of reflection than peers who did not report prior suicidal thoughts and behaviors. Additional findings of the study noted participants who reported only experiencing prior suicidal ideation endorsed similar levels of brooding relative to reflection, whereas individuals who previously attempted suicide endorsed greater levels of brooding relative to reflection, indicating brooding may be associated with more severe pathology (Crane et al., 2007).

      In contrast, other research asserts that reflection exerts unique and strong effects on suicidal ideation. For example, one study reported that brooding, and not reflection, was significantly positively associated with suicidal ideation; but that reflection, and not brooding, interacted with a history of suicide attempts to predict suicidal ideation

(Surrence, Miranda, Marroquín, & Chan, 2009). In another study, high levels of self-criticism interacted with reflection to positively predict suicidal ideation (Stange et al., 2015). An additional study noted that sleep quality moderated a relationship between reflection and suicidal ideation, such that reflection was most strongly associated with suicidal ideation among college students with the poorest sleep quality relative to peers (Holdaway et al., 2018). However, another study that compared predictors of suicide attempts and non-suicidal self-injury among college students found brooding was related to five times greater odds of endorsing prior suicide attempts. In the same study, reflection was associated with 1.6 times greater odds of endorsing prior non-suicidal self-injury, potentially indicating that the difference between brooding and reflection may be one of both function and severity (Polanco-Roman, Jurska, Quiñones, & Miranda, 2015). In addition, Cheref, Lane, Polanco-Roman, Gadol, and Miranda (2015) reported that reflection interacted with biracial racial/ethnic status to predict higher levels of suicidal ideation than among Black and Latino peers, suggesting reflection may be subject to variation by culture, intersectional identity, or different experiences of discrimination.

Other research indicates that reflection may influence the effect of brooding on suicidal thoughts and behaviors and covariates related to suicidal thoughts and behaviors. Specifically, in a prior study of ruminative subtypes, emotional urgency, and suicidal thoughts and behaviors, high levels of brooding and average levels of reflection were, in conjunction, found to be associated with elevated negative emotional urgency, a factor previously implicated in other research as a risk factor for suicidal thoughts and behaviors (Valderrama et al., 2016). Consistent with this research, Cole et al. (2015) reported a relationship between perceived stress and suicidal ideation that was

significantly moderated by brooding at low and moderate levels of reflection. These studies indicate that brooding and reflection may influence one another and, in turn, influence suicidal thoughts and behaviors, but also suggest that emotional arousal may play a role in explaining the differential influence of brooding, versus reflection, on suicidal thoughts and behaviors. However, these studies do not address whether reflection as a problem-focused review is adaptive in the context of cognitive inflexibility.

Cognitive Inflexibility

Cognitive inflexibility entails a perseverative focus on previously employed strategies and heuristics without attention to their prior effectiveness or current relevance, to the potential exclusion of useful novel information (Giner, Blasco-Fontecilla, De La Vega, & Courtet, 2016). Previous research indicates that cognitive inflexibility maladaptively influences suicidal thoughts and behaviors. For example, two prior studies of psychiatric inpatients diagnosed with major depressive disorder that measured cognitive inflexibility via the Wisconsin Card Sorting Test reported significant positive associations of cognitive inflexibility with suicidal ideation (Marzuk, Hartwell, Leon, & Portera, 2005) and prior suicide attempts (McGirr, Dombrovski, Butters, Clark, & Szanto, 2012). Among emerging adults, cognitive inflexibility has been reported to be greater among suicidal individuals with subclinical levels of compulsive gambling symptoms than among non-suicidal peers (Grant, Derbyshire, Leppink, & Chamberlain, 2014). In another study of emerging adults, cognitive inflexibility predicted suicidal ideation among individuals with a prior history of suicide attempts (Miranda, Gallagher, Bauchner, Vaysman, & Marroquín, 2012).

7

Cognitive inflexibility also has been linked to depressive rumination. For example, in another study that measured cognitive inflexibility via the Wisconsin Card Sorting Test, participants who engaged in depressive rumination were revealed to score significantly greater scores on perseverative errors than their non-ruminative peers (Davis & Nolen-Hoeksema, 2000). This study did not explore potential differences in cognitive flexibility by ruminative subtype. However, a third study employing the Wisconsin Card Sorting Test indicated that the relationship between cognitive flexibility and suicidal ideation was mediated by brooding, followed by hopelessness, such that brooding was positively associated with hopelessness, and hopelessness, in turn, was positively associated with suicidal ideation (Miranda, Valderrama, Tsypes, Gadol, & Gallagher, 2013). In contrast, in another study that focused upon non-suicidal self-injury and suicide attempts, cognitive inflexibility was not significantly predictive of either outcome and did not significantly influence the effect of depressive rumination on these outcomes (Polanco-Roman et al., 2015).

Cognitive inflexibility is thought to maintain depressive rumination by causing the individual to remain stuck in a repetitive review of thoughts and feelings relating to depressive symptoms and their consequences, constricting the suicidal individual's view of potential problem-solving strategies other than suicide (Law & Tucker, 2017). Other ways in which cognitive inflexibility could influence suicidal thoughts and behaviors have received minimal attention in prior research. Nock and Mendes (2008) implicitly suggested an alternative in a study of non-suicidal self-injury. In this study, the Wisconsin Card Sorting Test was modified so that adolescent participants received feedback that they had answered most items incorrectly, in order to increase their levels

of distress and physiological arousal to model how such increased arousal might influence their problem-solving capability during a period of elevated distress. Nock and Mendes (2008) found that consistent with their hypothesis, self-injurers demonstrated significantly greater physiological arousal, less distress tolerance of the task, and lower levels of social problem-solving effectiveness and capability in generating solutions to problems than peers who did not engage in self-injury. Though this study did not directly study cognitive inflexibility, it induced physiological arousal and increased emotional distress by simulating a high degree of cognitive inflexibility among its participants with a distress induction based directly upon the Wisconsin Card Sorting Test, a test whose primary purpose is to measure cognitive inflexibility. This suggests elevated distress levels arising from cognitive inflexibility may be a secondary influence on self-harm, in addition to a reduced capacity to generate alternative solutions to self-harm. Such a possibility has received minimal attention in prior research.

Social Problem-Solving

Social problem-solving is defined as the "Multidimensional meta-process of ideographically identifying and selecting a set of coping responses to carry out in order to effectively address the particular (and potentially unique) features of a given stressful situation" (Nezu, Maguth Nezu, & D'Zurilla, 2013, p. 8). Social problem-solving has been studied in the context of suicidal thoughts and behaviors at both a general and dimensional level. At the general level, D'Zurilla, Chang, Nottingham, and Faccini (1998) reported in separate studies of suicidal risk and suicidal ideation that social problem-solving deficits respectively accounted for 30.5% and 12.1% of the variance in these outcomes. A review of studies that compared adolescents with suicide attempts to

9

peers in psychiatric units without attempts, and to peers without prior attempts who were not in psychiatric care, reported social problem-solving deficits were associated with a history of suicide attempts; but few of these differences remained significant after adjusting for depression (Speckens & Hawton, 2005). However, another review reported that deficits in problem-solving skills are positively associated with suicidal thoughts and behaviors (Giner et al., 2016). Other studies have reported that social problem-solving predicted suicidal ideation among high school students (Chang, 2002b), and that among college undergraduates, high levels of social problem-solving ability were significantly related to lower risk for suicidal behaviors associated with non-suicidal self-injury, relative to participants with low levels of social problem-solving ability (Walker, Hirsch, Chang, & Jeglic, 2017).

Social problem-solving has also been implicated in indirect relationships with suicidal thoughts. For example, among high school students, social problem-solving has been reported to partially mediate a relationship between life stress and suicidal ideation (Chang, 2002b), whereas among female emerging adult university students, social problem-solving indirectly predicted suicidal ideation via a relationship that was mediated by hopelessness and moderated by depressive symptoms (Bozzay, Karver, & Verona, 2016). Low levels of social problem-solving ability have also been reported to augment the influence of perfectionism on suicidal ideation among college students (Chang, 2002a), to increase the influence of loneliness and life stress on suicidal behavior among college students (Hirsch, Chang, & Jeglic, 2012), and to strengthen a relationship between neuroticism and suicidal behavior mediated by hopelessness among low income primary care patients (Walker, Chang, & Hirsch, 2017).

Social Problem-Solving Orientations

One category of social problem-solving is problem-solving orientation. Problem-solving orientations consist of cognitions and emotions that are held by an individual concerning problems encountered in daily life and perceived self-efficacy in addressing these problems (Nezu et al., 2013). Problem-solving orientations include a positive problem-solving orientation (i.e., Problem-solving characterized by optimism and self-efficacy), and a negative problem-solving orientation (i.e., Problem-solving characterized by pessimism and a lack of self-efficacy; Nezu et al., 2013). In contrast to how they were conceived of in the original social problem-solving model, problem-solving orientations are currently conceptualized as distinct rather than two opposite poles of a continuum (Nezu et al., 2013).

Negative problem-solving orientation has been reported to be more frequently endorsed among suicide attempters age 60 and above compared to similarly aged peers (Gibbs et al., 2009), to mediate a relationship between family history and prior suicide attempts among recent suicide attempters (Jeglic, Sharp, Chapman, Brown, & Beck, 2005), and to be more likely to be associated with suicidal ideation among adolescent boys than girls (Labelle, Breton, Pouliot, Dufresne, & Berthiaume, 2013). In addition, both positive and negative problem-solving orientations negatively predicted suicidal ideation among a sample of American college students (Chang & Hirsch, 2015).

Social Problem-Solving Styles

The second dimension of social problem-solving is problem-solving style. "Problem-solving style refers to the set of cognitive-behavioral activities that people engage in when attempting to solve or cope with stressful problems" (Nezu et al., 2013,

p. 12-13). Problem-solving styles include planful problem-solving style (i.e., Formerly called a rational problem-solving style and characterized by a planful problem-solving approach), avoidant problem-solving style (i.e., Characterized by procrastination and passivity), and impulsive/careless problem-solving style (i.e., Characterized by impulsive or careless attempts at problem resolution; Nezu et al., 2013).

In prior research, avoidant and impulsive/careless problem-solving styles have predicted suicidal ideation among clinically depressed adolescents (Becker-Weidman, Jacobs, Reinecke, Silva, & March, 2010). They also have been significantly more frequently associated with a borderline personality disorder diagnosis among suicide attempters (Berk, Jeglic, Brown, Henriques, & Beck, 2007). In addition, avoidant and impulsive/careless problem-solving styles have been more frequently endorsed among individuals age 60 and older with prior suicide attempts than among similarly aged participants who lacked prior attempts or a current depression diagnosis (Gibbs et al., 2009). In contrast, among a sample of female survivors of sexual assault impulsive/careless problem-solving style negatively predicted suicidal ideation (Chang & Hirsch, 2015). Prior studies of suicidal ideation among adolescents have further reported that among Chinese participants with a history of physical abuse, endorsement of a planful problem-solving style was significantly inversely associated with suicidal ideation (Kwok, Yeung, Low, Lo, & Tam, 2015). In addition, in a Quebec based study adolescent boys with an avoidant problem-solving style were more likely to report suicidal ideation than girls (Labelle et al., 2013).

Social Problem-Solving and Rumination

Nascent research suggests potential relationships between social problem-solving and depressive rumination. For example, a prior review of cognitive and affective correlates of suicidal thoughts and behavior reported that depressive rumination was positively associated with cognitive inflexibility and deficits in problem-solving (Giner et al., 2016). Additionally, studies of individuals with major depression have reported that depressive rumination positively predicted problem-solving deficits (Donaldson & Lam, 2004), predicted overgeneralization in autobiographical memory that in turn predicted problem-solving deficits among adult participants (Raes et al., 2005), and predicted social problem-solving deficits that in turn predicted depressive symptoms among Thai children (Vatanasin, Thapinta, Thompson, & Thungjaroenkul, 2012).

Concerning ruminative subtypes, an Egyptian study of individuals who had recently attempted suicide reported that deficits in social problem-solving skills mediated a relation between brooding and suicide intent (Sharaf, Lachine, & Thompson, 2017). In addition, two studies that examined ruminative subtypes, social problem-solving, and depressive symptoms, among Japanese university students, reported that brooding was positively correlated with a negative problem orientation, a planful problem-solving style, and an avoidant problem-solving style. In contrast, reflection was positively correlated with a positive problem orientation and a planful problem-solving style, suggesting that reflection might be associated with more problem-solving self-efficacy and less negatively valanced emotional arousal than brooding (Hasegawa et al., 2015, 2016).

Consistent with this idea, an earlier study of emerging adults in the United States reported that brooding partially mediated the relationship between passive coping (i.e.,

13

characterized by the denial of problems and behavioral disengagement from attempting to cope) and depressive symptoms, and interacted with passive coping to positively predict depressive symptoms (Marroquín, Fontes, Scilletta, & Miranda, 2010). This study additionally reported reflection interacted with active coping (i.e., actively trying to address problems and to make efforts at planning) to positively predict depressive symptoms at average and high levels of reflection (Marroquín et al., 2010). This study was, in turn, an effort to expand upon the findings of Burwell and Shirk (2007), which reported that passive coping strategies were positively correlated with brooding, whereas active strategies were associated with reflection. It is unclear, however, whether these findings regarding ruminative subtypes, passive versus active coping, and depressive symptoms (Burwell & Shirk, 2007; Hasegawa et al., 2015, 2016; Marroquín et al., 2010) generalize to suicidal thoughts and behaviors. One way this generalization might occur is via associations with compatible problem-solving orientations and styles. For example, a more passive exploration of negative emotions (i.e., brooding) may be more associated with pessimism and lower self-efficacy in problem-solving orientation (i.e., negative problem orientation) and a problem-solving style characterized by avoidance or dependence on others (i.e., avoidant problem-solving style). A more problem-focused ruminative style (i.e., reflection) might better align with problem-solving styles that are associated with resolving problems (i.e., impulsive/careless and planful problem-solving styles). However, the choice between a planful problem-solving style, versus an impulsive/careless style, may also be dictated by cognitive inflexibility, as individuals who experience difficulty crafting solutions may be more likely to choose the first

solution that comes to mind impulsively (i.e., impulsive), versus an individual who can generate multiple solutions from which to select the most optimal solution (i.e.; planful).

Emotion Reactivity

Emotion reactivity is defined as the extent to which strong negative affect is triggered in response to a stressful event (Nock, Wedig, Holmberg, & Hooley, 2008). Emotion reactivity has received limited attention in research related to suicidal thoughts and behaviors. Nock et al. (2008) reported that emotion reactivity significantly mediated a relationship between psychopathology and suicidal ideation. In another study emotion reactivity, conceptualized as neuroticism, predicted suicidal ideation but did not significantly mediate a relationship between depressed mood and suicidal ideation (Cameron et al., 2017). In contrast to this study, additional research reported emotion reactivity mediated the relationship between depressive symptoms and suicide attempts but only among female and not male participants (Kleiman, Ammerman, Look, Berman, & McCloskey, 2014). More recent research among emerging adults has indicated that depressive symptoms mediated a relationship between emotion reactivity and suicidal ideation (Polanco-Roman, Moore, Tsypes, Jacobson, & Miranda, 2018). In addition, a study of adolescents and young adults reported that low to moderate levels of social problem-solving ability moderated a relation between emotion reactivity and suicide attempts (Dour, Cha, & Nock, 2011). Further study of emotion reactivity is needed to understand its potential effect on arousal levels that could influence depressive rumination subtypes such as brooding and reflection.

Covariates of Suicidal Thoughts and Behaviors

Depressive Symptoms

Positive associations between depressive symptoms and suicidal ideation and suicide risk have been reported widely in prior research (Brown et al., 2000; Cukrowicz et al., 2011; Garlow et al., 2008). At elevated levels of intensity, depressive symptoms have been positively associated with wanting to die, with this being the most substantive reason for a prior suicide attempt among repeat attempters (Jacobson et al., 2013). In addition, longitudinal research has reported that depressive symptoms have mediated the relationship between reasons for dying and suicide ideation (Brüdern et al., 2018). Prior research reports that depressive symptoms have frequently been associated with other factors that influence suicidal thoughts and behaviors such as cognitive flexibility (Davis & Nolen-Hoeksema, 2000; Law & Tucker, 2017), depressive rumination (Burwell & Shirk, 2007; Chan et al., 2009; Hasegawa et al., 2015, 2016; Marroquín et al., 2010; Polanco-Roman et al., 2016), social problem-solving (Becker-Weidman et al., 2010; Vatanasin et al., 2012), and emotion reactivity (Kleiman et al., 2014; Polanco-Roman et al., 2018). These findings, which relate depressive symptoms directly and indirectly to suicidal thoughts and behaviors, suggest that depressive symptoms are an important covariate of suicidal thoughts and behaviors.

Hopelessness

Hopelessness entails believing that unwanted future outcomes are unavoidable and desired future outcomes are unattainable (Abramson, Metalsky, & Alloy, 1989). Prior research indicates hopelessness is a robust risk factor for suicidal thoughts and behaviors (Brown et al., 2000; Christensen, Batterham, Soubelet, & Mackinnon, 2013;

Smith, Alloy, & Abramson, 2006; Van Orden et al., 2010). In addition, prior research indicates that hopelessness is positively associated with other risk factors for suicidal thoughts and behaviors such as depressive rumination (Miranda, Tsypes et al., 2013, Morrison & O'Connor, 2008b) and social problem-solving (Bozzay et al., 2016; Walker, Chang, et al., 2017). These findings indicate hopelessness is an important covariate of suicidal thoughts and behaviors and of other covariates related to suicidal thoughts and behavior.

Summary

The literature indicates that depressive rumination maladaptively influences the onset and maintenance of suicidal thoughts and behaviors. However, most individuals who engage in depressive rumination and/or experience depressive symptoms do not engage in suicidal thoughts and behaviors. In addition, the literature reports brooding is consistently and positively associated with suicidal thoughts and behaviors both directly and indirectly, whereas the nature of reflection's relationship with suicidal thoughts and behaviors remains inconsistent.

Further elucidation of the relationship between depressive rumination subtypes and suicidal thoughts and behaviors has the potential to inform therapeutic interventions. Currently, therapeutic interventions specifically designed to address suicidality remain limited to Dialectical Behavior Therapy (Linehan, 1993) and the treatment system defined by Jobes, Lento, and Brazaitis (2012) which is known as the Collaborative Assessment and Management of Suicidality.

More generally, therapeutic interventions often constructively employ the use of a repetitive review of thoughts and emotions. For example, cognitive therapy advocates

the logging and review of automatic thoughts and associated emotions, triggers, behaviors, and alternative cognitions (Beck, 2011). In addition, therapies focused on posttraumatic stress disorder often intentionally require the systematic and repetitive review of cognitions and emotions associated with circumstances surrounding prior trauma (Foa, Hembree, & Rothbaum, 2007; Resick, Monson, & Chard, 2017). This suggests that not all perseverative cognitive/affective processes are maladaptive and is consistent with literature that indicates reflection can, under certain circumstances, exert a benign or neutral influence upon suicidal thoughts and behaviors. This poses the question, when and under what circumstances does perseverative thought, and specifically depressive rumination, exert a maladaptive versus adaptive influence upon suicidal thoughts and behaviors?

Understanding the influence of factors such as cognitive inflexibility and emotion reactivity upon depressive rumination, which have on their own been positively associated with suicidal thoughts and behaviors, may help to identify which individuals engaged in depressive rumination may be at increased risk for suicidal thoughts and behaviors. Potentially such individuals may include those that experience elevated levels of emotion reactivity and cognitive inflexibility, factors that are respectively implicated in maintaining elevated levels of deleterious emotional arousal and impede conceiving of alternate solutions to self-harm. Identifying these individuals early in psychotherapy may potentially help to direct the focus of treatment towards suicide prevention efforts, which may include interventions designed to increase flexible thinking and emotion regulation strategies. Such techniques are currently employed in some therapies but are frequently administered as part of a barrage of techniques rather than being specifically targeted.

Elucidating the role of cognitive inflexibility and emotion reactivity in influencing depressive rumination may also help increase the use of adaptive styles of social problem-solving, which have themselves previously been linked to suicidal thoughts and behaviors. Social problem-solving efforts designed to prevent self-harm may be impeded by thought processes characterized by a lack of alternate courses of action to self-harm and further impeded by toxic levels of negatively valanced emotional arousal that also impedes generation of alternatives, and may additionally promote avoidance.

The Proposed Study

Despite the prior research on depressive rumination and its subtypes, cognitive inflexibility, social problem-solving, and suicidal thoughts and behaviors, certain questions regarding these factors still merit further investigation. For example, what cognitive and affective factors influence engagement in brooding and reflection, known risk factors for suicidality? In addition, what cognitive and affective factors influence whether reflection is an adaptive or maladaptive process for a given individual with regard to suicidality?

The present study posits cognitive inflexibility will maladaptively influence suicidal thoughts in two distinct ways, through a decreased capability to generate alternate courses of action, and through increased arousal. The amount of arousal experienced is posited to be influenced by individual differences in levels of cognitive inflexibility and emotion reactivity. Those who are more reactive are expected to experience more arousal and frustration arising from cognitive inflexibility in response to greater difficulty in generating potential alternatives for managing social problems. Brooding, a more emotion-focused and passive form of depressive rumination, is

anticipated to be more likely to be associated with increased arousal. As a passive form of addressing problems brooding is expected, in turn, to foster a passive problem-solving style, specifically, avoidant problem-solving. Consistent with prior research avoidant problem-solving is anticipated to be positively associated with suicidal ideation.

Less emotionally reactive cognitively inflexible individuals are expected to experience relatively lower levels of arousal compared to those with higher levels of emotion reactivity. These individuals may instead engage in reflection, a more active and problem-focused form of depressive rumination, given their relatively lower levels of arousal. However, as detailed in prior literature, reflection is not always adaptive, and this may be explained by increased cognitive inflexibility. These individuals, given their engagement in reflection, a more active problem-focused subtype of rumination, are anticipated to be more likely to engage in an active style of problem-solving. However, given their difficulty generating alternatives, these individuals are expected to have fewer alternatives from which to choose and are expected to be more likely to undertake whatever solution(s) they were able to generate with little planning. Therefore, they are posited to be more likely to engage in impulsive/careless problem solving. Consistent with prior research impulsive/careless problem solving is anticipated to be positively associated with suicidal ideation.

Individuals who are not elevated in cognitive inflexibility are expected to experience a lower degree of arousal and a greater degree of capability in generating alternative courses of action. These individuals are also anticipated to engage in reflection in response to distress, the more active problem-focused style of rumination, but given their greater levels of cognitive flexibility they may be more likely to engage in

20

planful problem-solving, as they are more likely to be able to pick from a larger pool of potential solutions than they were able to generate than individuals who are elevated in cognitive inflexibility. Planful problem-solving, in accordance with prior research, is anticipated to negatively be associated with suicidal ideation.

Risks versus Benefits of the Proposed Study

Often there is apprehension about conducting clinical and research inquiries into suicidal thoughts and behaviors based upon the belief that asking about suicidal thoughts and behaviors encourages them. However, prior research indicates that this is not the case. For example, in one prior study conducted at six high schools, students that answered questions about suicide were as likely to report suicidal ideation as those who were not required to answer such questions (Gould et al., 2005). In addition, high-risk students asked to answer these questions reported less distress than high-risk peers who did not answer suicide-related questions (Gould et al., 2005). A later review of studies that inquired about suicidal thoughts and behavior reported similar findings, indicating that inquiring about suicidal thoughts and behaviors was not linked to an increase in suicidal ideation but was instead associated with a decrease in ideation (Dazzi, Gribble, Wessely & Fear, 2014). The proposed study further creates an opportunity to provide intervention to individuals who might not otherwise seek out mental health services, via direct services in the Campus Counseling Center and through referrals provided during debriefing.

Hypotheses

1. Cognitive inflexibility will be significantly positively correlated with impulsive/careless problem-solving.

2. Cognitive inflexibility will be significantly negatively correlated with planful problem-solving.

3. Emotion reactivity will be significantly and more strongly positively correlated with brooding than reflection.

4. Avoidant problem-solving will mediate a relation between brooding and suicidal ideation.

5. Impulsive/careless problem-solving will mediate a relation between reflection and suicidal ideation.

6. Planful problem-solving will mediate a relation between reflection and suicidal ideation.

7. Cognitive inflexibility will moderate relations between each depressive rumination subtype and problem-solving style, and emotion reactivity will moderate cognitive inflexibility's influence as a moderator of these relations. The directions of these relationships will be as previously described in "The Proposed Study" section.

Method

Participants

A sample of emerging adults who were college undergraduate students ($N = 162$; 75% female), ages 18 to 29 ($M = 19.36$, $SD = 1.61$) were recruited from an urban private university in the NYC metropolitan area to participate for the fulfillment of a research requirement in an Introduction to Psychology course, or monetary compensation ($10). See Table 1 for the distribution of participants by categories such as race, ethnicity, gender, sexual orientation, endorsement of suicidal ideation within the 12 months prior to study participation, and endorsement of having made at least one prior suicide attempt.

Statistical power was estimated with G*Power (version 3.1.9.2) using a model compatible with multiple linear regressions. Power estimates were based on five key predictor variables and two covariates. Prior studies on factors positively associated with suicidal ideation that are part of the proposed study have reported medium effect sizes in their predictions of suicidal ideation (Chang & Hirsch, 2015; Cheref et al., 2015; Sharaf et al., 2017). Given this, a medium effect size of .15 was included in the power analysis. Based on this (power = .80, $\alpha = .05$, two-tailed test) a sample size of at least 114 participants was determined to be needed.

Materials

Brooding and Reflective Rumination

Rumination was assessed via the Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991), a 22-item self-report measure. The measure queries respondents about their response patterns to sad or depressed moods by thinking about the causes, meanings, and consequences of their mood. Treynor et al. (2003) conducted a

factor analysis from which the Brooding (e.g., "Think 'What am I doing to deserve

this'") and Reflection (e.g., "Analyze recent events to try to understand why you are

depressed") subscales were identified. These scales consist of 5 items each and are rated

by participants on a scale of 1 (almost never) to 4 (almost always). They have shown

satisfactory reliability in prior research (α = .77 for the brooding subscale and α = .72 for

the reflection subscale) and the present study (α = .80 for both subscales). The remaining

12 items of the RRS were insufficiently distinct from depressive symptoms in the factor

analysis (Treynor et al., 2003; see also Burwell & Shirk, 2007) and, as such, were omitted

from the present study. Scores on each subscale can range from 5 to 20. The RRS has, in

prior research, has had good predictive validity regarding untreated depression in

community samples, good convergent validity with measures of depressive symptoms

and neuroticism, and good divergent validity from scales of dispositional optimism and

social support (Luminet, 2004).

Cognitive Inflexibility

Cognitive inflexibility was assessed via an online version of the Wisconsin Card

Sorting Test (WCST; Stoet, 2010, 2017). The WCST tests abstract reasoning and the

ability to change card sorting strategies in response to changes in card sorting rules.

Participants must match the target card to one of four key cards by number, shape, or

color. Participants must also deduce the sorting rule based on feedback about whether

they answered correctly. After a predetermined number of successful matches, the card

sorting rule changes, and participants must deduce the new sorting rule and follow it to

correctly match the cards. When participants follow an old sorting rule despite receiving

feedback that their response is incorrect, a perseverative error is recorded. The total

number of perseverative errors represent the participant's cognitive inflexibility score. In prior research, perseverative errors on the WCST have not been correlated with working memory (Davis & Nolen-Hoksema, 2000). Interscorer reliability ranged between .88 and .93 among expert users and .75 to .97 among novice users, suggesting good to excellent reliability (Heaton, Chelune, Talley, Kay, & Curtiss, 1993). The WCST has also demonstrated suitable criterion, convergent, and divergent validity among university students compared to peers with schizophrenia (Sullivan et al., 1993).

Demographic Information

Participants completed a self-report questionnaire asking for their race/ethnicity, age, gender, and sexual orientation.

Depressive Symptoms

The Beck Depression Inventory (BDI-II; Beck, Brown, & Steer, 1996) was used to assess depressive symptom severity. Participants were instructed to answer the 21-item scale while recalling the two-week period prior to participation. Potential item responses ranged from 0 to 3, and total scores from 0 to 60. The BDI-II has shown strong internal consistency reliability among college students in past and present research (α = .93 for both); and exhibits high concurrent validity (r = .71), but moderate discriminant validity (r = .47) from the Hamilton Psychiatric Rating Scale for Depression-Revised (Beck et al., 1996).

Emotion Reactivity

The 21-item Emotion Reactivity Scale (ERS; Nock et al., 2008) is a self-report questionnaire that assesses emotion sensitivity (e.g., "Other people tell me I'm overreacting"), intensity (e.g., "When I experience emotions, I feel them very

strongly/intensely"), and persistence (e.g., "When something happens that upsets me, it's all I can think about for a long time"). Responses are scored on a 5-point Likert scale ranging from 0 (not at all like me) to 4 (completely like me). The ERS has high internal consistency reliability in past research (α = .94) and the present study (α = .95). It also has convergent validity with other measures of emotion reactivity, including the Early Adolescent Temperament Questionnaire (Rothbart, Ahadi, & Evans, 2000) and the behavioral inhibition/behavioral activation scale (Carver & White, 1994).

Hopelessness

The Beck Hopelessness Scale (BHS; Beck & Steer, 1988) measures expectations regarding negative future outcomes with 20 (11 negatively and 9 positively phrased) true/false statements. Scores can range from 0 to 20. The BHS has shown strong internal consistency reliability in past research (α = .82 to .93; Beck & Steer, 1988) and the present study (α = .91); and adequate concurrent validity with clinicians' ratings of hopelessness (r = .74; Beck & Steer, 1993).

Social Problem-Solving

The Social Problem-Solving Inventory-Revised, short form (SPSI-R:S) is described as a self-report instrument that assesses an individual's ability to resolve problems in their everyday lives (D'Zurilla & Nezu, 1982, 1999). The SPSI-R:S form has 25 items. The measure uses a Likert-type scale format asking respondents to rate their responses on a scale from 0 (Not at all true of me) to 4 (Extremely true of me). The measure includes five subscales, a positive problem orientation scale, a negative problem orientation scale, a planful problem-solving style scale, an impulsive/careless problem-solving style scale, and an avoidant problem-solving style scale. Responses for each item

of a scale are summed. The sums for only the negative problem orientation scale, the

impulsive/careless problem-solving style scale, and the avoidant problem-solving style

scale are then subtracted from 20. These scores for all five scales represent the raw score

for each scale. All scale raw scores are then summed to calculate a total SPSI-R:S raw

score. All raw scores, including the total SPSI-R:S raw score, are then compared to a

table that is supplied with the measure to determine their final scores, which are weighted

differently by three age ranges, young adult, mature adult, and elderly adult. For the

present study, only the young adult range (17 to 39 years of age) was used; and only

scales about problem-solving styles were used, as these were the only scales that were the

subject of the present study's hypotheses.

Cronbach's alpha estimates have been reported as adequate to high (α =.68 to .91)

for the measure's various scales (D'Zurilla & Nezu, 1982, 1999). These estimates suggest

that the SPSI-R:S has relatively stable test-retest reliability. In the present study $\alpha = .85$

for the avoidant subscale, $\alpha = .66$ for the impulsive subscale, and $\alpha = .82$ for the planful

problem-solving scale. The measure has also been reported to have adequate concurrent

validity (D'Zurilla & Nezu, 1982, 1999).

Suicidal Thoughts and Behaviors

The revised 4-item Suicidal Thoughts and Behaviors Questionnaire (SBQ-R;

Osman et al., 2001) assesses lifetime suicidal ideation and/or suicide attempts, the

frequency of suicidal ideation over the past 12 months, the threat of a suicide attempt,

and the self-reported likelihood of suicidal behavior in the future. Total scores range

from 3 to 18. The SBQ-R has been reported to have good internal consistency reliability

in an undergraduate sample and has been validated with other measures of suicide risk

(Osman et al., 2001). In the present study, only the second item, which queries

participants about suicidal ideation in the past 12 months on a five point scale, was used,

as the present study focused solely on suicidal ideation. This item constituted the

dependent measure. A fifth unscored item was added and displayed conditionally after

the other SBQ items if having made a prior suicide attempt was endorsed. It stated,

"Please state the number of times you previously attempted suicide:".

Procedures

Participants registered for study participation via the SONA system. Participant study appointments were one hour in length, and were run individually or in small groups in a student computer lab of the psychology department of an urban Northeastern private university. At their study appointment, after being provided with informed consent in compliance with the Institutional Review Board of St. John's University, participants completed via computer, the WCST, and then a randomized (to adjust for potential effects of survey order) battery of self-report measures that included the BDI-II, BHS, ERS, RRS, SPSI-R:S, and SBQ-R. Participants who endorsed a response greater than 0 in response to question 9 on the BDI-II or greater than 1 in response to question 4 of the SBQ-R were assessed by a research assistant for suicide risk. All research assistants were undergraduate and graduate students trained extensively in suicide risk assessment by the principle investigator, a Ph.D. student in a clinical psychology program, and were supervised in at least three consecutive participant appointments prior to being permitted to run participants on their own. Individuals who endorsed active suicidal ideation and could not contract for safety were to be escorted to the Campus Counseling Center (CCC). However, no student met these criteria during recruitment. Appointments for the study were only be run during the hours of operation of the CCC, and concluded no later than one hour before clinic closing. After completing all study measures, all participants were debriefed and received a list of mental health resources including contact information for the Campus Counseling Center. Participants were compensated with their choice of one research credit or 10 dollars for participation.

Analytical Plan

Means, standard deviations, and bivariate correlations between all study variables were examined via SPSS, Version 25. Hypotheses 1, 2, and 3 were tested via a review of a correlation matrix computed between all study variables. Four models were tested for parsimony in explaining relations between study variables and suicidal ideation.

The first model was a hierarchical multiple linear regression conducted in two blocks. In block 1, the control variables Depressive Symptoms and Hopelessness were entered as predictors of suicidal ideation. In block 2 all other study variables (e.g., Brooding, Reflection, Emotion Reactivity, Cognitive Inflexibility, Planful Problem-Solving, Impulsive Problem-Solving, and Avoidant Problem-Solving) were entered into the model. These predictors were entered in a second block to evaluate how much of the variance they accounted for beyond the control variables, Depressive Symptoms and Hopelessness.

Path analyses for the second, third, and fourth models were conducted with the *lavaan* package (Rosseel, 2012) of R (R Core Team, 2017). The second model was used to test hypotheses 4, 5, and 6 and was a path analysis that specified two paths between reflection and suicidal ideation mediated by planful problem-solving and impulsive problem-solving respectively; and an additional path between brooding and suicidal ideation mediated by avoidant problem-solving.

The third model was identical to the second model except that it included cognitive inflexibility and emotion reactivity as moderators of separate relations between brooding and avoidant problem-solving style, and as moderators of separate relations between reflection and each of the other two problem-solving styles. Variables in the

model were centered around their means, and interaction terms were computed between reflection and cognitive inflexibility, reflection and emotion reactivity, brooding and cognitive inflexibility, and brooding and emotion reactivity, and entered into the model.

The fourth model was a test of the seventh hypothesis, and was also identical to the second model except that it included a 3-way interaction between brooding, cognitive inflexibility, and emotion reactivity, that predicted avoidant problem-solving; and separate 3-way interactions between reflection, cognitive inflexibility, and emotion reactivity as predictors of planful problem-solving and impulsive problem-solving. Variables in this model were centered around their means, and interaction terms were computed between reflection, cognitive inflexibility, and emotion reactivity; and brooding, cognitive inflexibility, and emotion reactivity; and entered into the model as described above. Depressive symptoms and hopelessness were also included in models 2, 3, and 4 as predictors of suicidal ideation to statistically adjust for their effects.

Goodness of fit statistics for models 2, 3, and 4 included the *p-value* of the model chi-square (χ^2), the model chi-square divided by its degrees of freedom ($\chi^2 / d.f.$), the Comparative Fit Index (CFI), the Tucker-Lewis Index (TLI), the Root Mean Square Error of Approximation (RMSEA), and the Standardized Root-Mean-square Residual (SRMR). Close model fit was suggested by a nonsignificant χ^2 goodness-of-fit statistic ($p > .05$), a $\chi^2 / d.f. <= 3$, a CFI > .95, a TFI > .95, a SRMR < .10, and a RMSEA < .05 (Cangur & Ercan, 2015; Fan, Thompson, & Wang, 1999; Hu & Bentler, 1999; Kline, 2005). The analysis plan also included using Akaike's Information Criterion (AIC) to assess models 2, 3, and 4. AIC is used to select a parsimonious model that best explains the data with a minimal number of estimated parameters by penalizing for the number of variables

estimated in the model (Burnham & Anderson, 2003; Claeskens & Hjort, 2008). With

AIC, the model with the lowest AIC score of several competing models is selected as the

one that best predicts the data in a data set.

Total indirect effects for each ruminative subtype through the proposed problem-

solving mediators were assessed using the bias-corrected percentile method to calculate

95% confidence intervals and their significance. These intervals have not been reported,

given the lack of significant indirect pathways to suicidal ideation mediated by problem-

solving variables (see Results section).

Each model was also bootstrapped, meaning repeated sampling from the observed

data was applied. This is considered to be a valid method for testing indirect effects, as it

yields confidence intervals of the effects (Williams & MacKinnon, 2008). Based on

Hayes' (2009) recommendation, 5000 bootstrapped samples to obtain the 95%

confidence intervals of the indirect effects were used.

The only missing data in the dataset was related to demographic variables. Thus,

methods to address missing data were neither needed nor used.

Results

Descriptive Statistics and Bivariate Correlations among Study Variables

See Table 2 for a list of the means and standard deviations for each of the study variables. See Table 3 to examine bivariate correlations between all study variables. Cognitive inflexibility was not correlated with any other study variable. Therefore, hypothesis 1 (Cognitive inflexibility will be significantly positively correlated with impulsive/careless problem-solving), and hypothesis 2 (Cognitive inflexibility will be significantly negatively correlated with planful problem-solving) were unsupported. In contrast, hypothesis 3 was supported by the data. Emotion reactivity was more strongly significantly positively correlated with brooding than reflection (see Table 3).

Model 1

Model 1 assumed all study variables other than the dependent measure, suicidal ideation, were independent predictors of suicidal ideation. For model 1, a hierarchical multiple linear regression analysis was conducted as described in the analytical plan.

In block 1 of model 1, Depressive symptoms ($b = .06$, $p < .001$, *partial r* $= .49$) and Hopelessness ($b = .08$, $p < .001$, *partial r* $= .34$) contributed significantly to the model, $F(2, 159) = 109.33$, $p < .001$, accounting for 58% of the variance in suicidal ideation.

In block 2 the remaining study variables were entered into the model as predictors of suicidal ideation as described in the analytical plan. Depressive symptoms ($b = .05$, $p < .001$, *partial r* $= .45$) and Hopelessness ($b = .09$, $p < .001$, *partial r* $= .33$) remained significant predictors of suicidal ideation but the other predictors were non-significant. Block 2 did not contribute significantly to the model, $F(7, 152) = .52$, $p = .82$, and the

change in R^2 was not statistically significant, accounting for less than 1% of the variance in suicidal ideation (See Table 4 and Figure 1).

Model 2

Model 2 tested hypotheses 4, 5, and 6, respectively that avoidant problem-solving would mediate a relation between brooding and suicidal ideation; and that impulsive and planful problem-solving styles would each mediate separate relationships between reflection and suicidal ideation. Accordingly, model 2 specified a path between brooding and suicidal ideation mediated by avoidant problem solving, and two paths between reflection and suicidal ideation, with the first mediated by impulsive problem-solving and the second mediated by planful problem-solving. Model 2 as hypothesized was a poor fit to the sample data given its fit indices (Model χ^2 $p < .000$; $\chi^2 / d.f. = 6.07$; CFI = .83; TLI = .58; RMSEA = .18; SRMR = .13; AIC = 3033). Additionally, inconsistent with hypotheses 4, 5, and 6, all pathways between depressive rumination subtypes and suicidal ideation mediated by problem-solving styles were non-significant. Partial support for hypotheses 4 and 6 was provided by brooding significantly predicting avoidant problem-solving ($B = .37$; $SE = .11$; $p < .001$) and reflection significantly predicting planful problem-solving ($B = .23$; $SE = .07$; $p = .002$). In addition, suicidal ideation was directly predicted by depressive symptoms ($B = .05$; $SE = .01$; $p < .001$) and hopelessness ($B = .09$; $SE = .03$; $p = .001$; see Table 5 and Figure 2).

Model modifications suggested by the modification indices function that were consistent with prior theory and research included adding new significant pathways to the previously identified significant pathways, where brooding predicted impulsive problem-solving ($B = .20$; $SE = .10$; $p = .037$) and avoidant problem-solving predicted depressive

34

symptoms ($B = 1.29$; $SE = .16$; $p < .001$). However, these modifications actually

decreased the model's goodness of fit according to all fit criteria (Model χ^2 $p < .000$; χ^2 /

$d.f. = 16.68$; CFI = .64; TLI = .09; RMSEA = .31; SRMR = .18; AIC = 4220). Additional

suggested modifications included adding new significant pathways to existing significant

pathways where brooding ($B = .69$; $SE = .20$; $p = .001$), reflection ($B = .76$; $SE = .17$; $p <$

.001), and hopelessness ($B = .98$; $SE = .17$; $p < .001$) predicted depressive symptoms, and

avoidant problem-solving predicted hopelessness ($B = .52$; $SE = .09$; $p < .001$). These

modifications brought the SRMR to a satisfactory level and the model's other fit criteria

nearer to satisfactory thresholds, but still did not meet them (Model χ^2 $p < .000$; χ^2 / $d.f.$ =

5.02; CFI = .93; TLI = .77; RMSEA = .06; SRMR = .10; AIC = 5029). A final suggested

modification entailed adding a pathway where brooding predicted hopelessness. This

pathway was significant ($B = .45$; $SE = .13$; $p < .001$) and other previously significant

pathways remained significant. This final modification resulted in the χ^2 / $d.f.,$ CFI, and

SRMR reaching satisfactory levels for model fit, but not the TLI or RMSEA (Model χ^2 p

$< .000$; χ^2 / $d.f.$ = 2.74; CFI = .97; TLI = .90; RMSEA = .10; SRMR = .06; AIC = 5010).

Thus, these additional model modifications failed to fully address poor model fit and

further complicated the model, belying its utility as a parsimonious tool for predicting

suicidal ideation.

Model 3

Model 3 attempted to improve the model fit and predictive capability of the

second model by adding cognitive inflexibility and emotion reactivity as separate

moderators of the relations of each ruminative subtype with hypothesized problem-

solving styles. The set of fit indices examined indicated that model 3 as hypothesized

was not an acceptable fit to the sample data (Model χ^2 $p < .000$; $\chi^2 / d.f. = 4.69$; CFI = .57; TLI = .38; RMSEA = .15; SRMR = .15; AIC = 5381). As in model 2 brooding significantly predicted avoidant problem-solving ($B = .37$; $SE = .11$; $p = .001$), reflection significantly predicted planful problem-solving ($B = .23$; $SE = .08$; $p = .002$), and depressive symptoms ($B = .05$; $SE = .01$; $p < .001$) and hopelessness ($B = .09$; $SE = .03$; $p = .001$) directly predicted suicidal ideation (see Table 6 and Figure 3).

Model modifications suggested by the Modification Indices function consistent with prior theory and research included adding pathways in which emotion reactivity separately predicted avoidant problem-solving, impulsive problem-solving, and planful problem-solving. Pathways between emotion reactivity and avoidant problem-solving ($B =.10$; $SE =.02$; $p < .001$) and emotion reactivity and impulsive problem-solving ($B =.05$; $SE =.02$; $p = .002$) were significant, but did not improve model fit to be within satisfactory thresholds (Model χ^2 $p < .000$; $\chi^2 / d.f. = 5.63$; CFI = .62; TLI = .38; RMSEA = .15; SRMR = .15; AIC =15307). Subsequent modifications specified pathways where brooding and reflection each separately predicted emotion reactivity. Brooding significantly predicted emotion reactivity ($B =3.34$; $SE =.02$; $p < .001$) and all previously significant pathways remained significant. Despite this, these modifications when applied did not result in the model's fit indices to be within satisfactory thresholds except for SRMR (Model χ^2 $p < .000$; $\chi^2 / d.f. = 4.16$; CFI = .87; TLI = .75; RMSEA = .14; SRMR = .10; AIC = 4330). Further modifications included adding separate pathways between reflection and avoidant problem-solving and reflection and planful problem-solving, of which the latter was significant ($B =.23$; $SE =.09$; $p = .010$). In addition, all previously reported significant pathways remained significant. These modifications

improved model fit but this fit was still subthreshold except for SRMR (Model χ^2 $p <$ .000; $\chi^2 / d.f. = 13.67$; CFI = .90; TLI = .78 ;RMSEA = .13; SRMR = .10; AIC = 4321).

Model 4

Model 4 attempted to test hypothesis 7 and improve the fit and predictive capability of the second model. This improvement was undertaken by adding cognitive inflexibility as a moderator of each depressive rumination subtype, and emotion reactivity as a moderator of the influence of cognitive inflexibility on each depressive rumination subtype. The set of fit indices examined indicated that model 4 as hypothesized was not an acceptable fit to the sample data (Model χ^2 $p < .000$; $\chi^2 / d.f. = 5.63$; CFI = .57; RMSEA = .17; SRMR = .16; AIC = 5376), refuting hypothesis 7. As in models 2 and 3 brooding significantly predicted avoidant problem-solving ($B = .37$; $SE = .11$; $p = .001$), reflection significantly predicted planful problem-solving ($B = .23$; $SE = .08$; $p = .003$), and depressive symptoms ($B = .05$; $SE = .01$; $p < .001$) and hopelessness ($B = .09$; $SE = .03$; $p = .001$) directly predicted suicidal ideation (see Table 7 and Figure 4).

Model modifications suggested by the Modification Indices function were inconsistent with prior theory and research. Specifically, the suggested modifications consisted of pathways that would have variables that are typically outcomes in the literature (i.e., depressive symptoms and suicidal ideation) predicting variables that are typically their predictors (i.e., depressive rumination subtypes and social problem-solving styles). Given this they were not applied.

Comparing Model Fits

See Table 8 to compare and contrast the summarized path models' goodness of fit statistics for models 2, 3, and 4. Such statistics were not available for model 1 as it was a

hierarchical multiple linear regression and not a path analysis. AIC scores suggest model

2 was the most parsimonious fit to the data, but since all the models were poor fits to the

data interpretations and comparisons should be made with caution.

Discussion

In 2016 in the US, the number of suicides peaked at 45,000 (Centers for Disease Control and Prevention, 2017) after 17 years of annual increase (Centers for Disease Control and Prevention, 2018). Emerging adulthood is a developmental period from 18 to 29 years of age (Arnett et al., 2014) associated with elevated levels of suicidal thoughts and planning (Substance Abuse and Mental Health Services Administration, 2014) and suicide risk (Centers for Disease Control and Prevention, 2015b). Research that can identify new targets for the screening and treatment of suicidal thoughts and behaviors among this population is essential. Current psychotherapies often seek to increase flexible thinking to aid in generating alternatives to social problems other than suicidal thoughts and behaviors. However, it is unclear whether their mechanisms of action are via this pathway exclusively, and/or whether cognitive inflexibility is itself an experience characterized by elevated emotional arousal which these therapies reduce.

The present study attempted to elucidate these mechanisms by examining whether cognitive inflexibility interacts with high levels of emotion reactivity (i.e., a tendency to experience strong negative affect in response to a stressful event) and brooding (i.e., a repetitive form of emotion driven thinking associated with depressive symptoms) to predict suicidal ideation via a relation that is mediated by avoidant problem-solving (i.e., a problem-solving style characterized by avoiding phenomena associated with a social problem including negative emotions). It also examined whether cognitive inflexibility interacts with low levels of emotion reactivity and reflection (i.e., a repetitive form of problem-oriented thinking that is focused on resolving depressive symptoms) to predict suicidal ideation via a relationship that is mediated by planful problem-solving at low

levels of cognitive inflexibility, and impulsive problem-solving at high levels of cognitive inflexibility.

The present study investigated multiple hypotheses related to cognitive inflexibility, and its relations with other cognitive/affective factors, in predicting suicidal ideation. These hypotheses predicted that cognitive inflexibility would be significantly positively correlated with impulsive/careless problem-solving, would be significantly negatively correlated with planful problem-solving, and would moderate relations between each ruminative subtype and problem-solving style that would further be moderated by emotion reactivity. These hypotheses were not supported. Cognitive inflexibility was in fact not correlated with any other study variable. There are several potential reasons for this. The first of which is that there may have been a restriction of range regarding cognitive inflexibility in the present study's sample. Scores for cognitive inflexibility ranged from 2 to 23, but its mean was 9.04 and its standard deviation was 4.26. This indicates limited overall variablility in scores registered by participants that may have limited the capability of the present study's statistical analyses to detect effects. Recruitment of individuals with a wider range of cognitive inflexibility scores potentially could create a sample that would support many of the present study's hypotheses, though this possibility is speculative and can only be confirmed with further research.

A second possible explanation is that the present study sampled emerging adults and cognitive flexibility has been well-documented to decline with age (Axelrod & Henry, 1992; Daigneault, Braun, & Whitaker, 1992; Heaton et al., 1993). Rates of suicide in the US have also been reported in recent years to peak in later developmental periods among both men and women (Hedegaard, Curtin, & Warner, 2020). It is possible that cognitive

inflexibility is most relevant in predicting suicidal thoughts and behaviors during these later developmental periods. However, minimal research exists examining this possibility, rendering it speculative.

A third potential explanation for the lack of significant correlations between cognitive flexibility and other study variables is that the Wisconsin Card Sorting Test, which requires sorting cards based on colors, shapes, and the number of symbols printed on each card, is too abstract a cognitive task to adequately measure the effects of cognitive inflexibility on social problems that may lead to suicidal thoughts and behaviors. Such a task may require a measure that gauges cognitive inflexibility specifically in a social context where social decision making is tested.

A fourth potential explanation for the current study's findings regarding cognitive inflexibility is that the experience of cognitive inflexibility may not be associated with experiences of increased emotional arousal. Individuals who consistently experience cognitive inflexibility may become more or less inured to the frustration born of a limited capacity for solution generation. This conflicts with the results of Nock and Mendes (2008), but it is possible that the emotional arousal and frustration experienced by participants in that study may have been more about participants being given negative feedback about their capacity for flexible thinking that was inconsistent with the feedback they had received in life prior to study participation.

Hypotheses that avoidant problem-solving would mediate a relation between brooding and suicidal ideation, and that impulsive problem-solving and planful problem-solving would mediate separate relations between reflection and suicidal ideation, were also unsupported. Suicidal ideation was significantly correlated with depressive

rumination subtypes and social problem-solving styles in directions consistent with prior research. Despite this, the hypothesized indirect relations were nonsignificant. It could be the absence of significant relations between these variables is due to an under-sampling of suicidal ideation in the present study. Though recruitment for the present study exceeded the number of participants specified by the present study's power analysis, reports of suicidal ideation and of symptom severity could have been insufficient to detect smaller effect sizes regarding suicidal ideation. This could be because the present study's sample was a community sample and not a clinical sample. In prior research, avoidant and impulsive/careless problem-solving styles have both predicted suicidal ideation in clinical samples (Becker-Weidman et al., 2010; Berk et al., 2007). It could also be because approximately 60% of participants in the present study were from racial groups (see Table 1) for whom rates of suicide are substantially lower in prevalence than among Caucasian individuals (Curtin & Hedegaard, 2019).

An alternate explanation for the lack of significant indirect relations mediated by problem-solving styles could be that the Social Problem-Solving Inventory is a self-report measure, and respondents could be biased or inaccurate in their endorsement of social problem-solving styles. To circumvent such an issue, a measure such as the Mean Ends Problem-Solving Procedure (Marx, Williams, & Claridge, 1992) might have been better suited. This task requires respondents to read and finish partially complete scenarios about social problems with their custom solutions. Such a performance-based measure could potentially circumvent issues due to reporting biases and may more accurately gauge social problem-solving capability.

Emotion reactivity was also hypothesized to be significantly and more strongly positively correlated with brooding than reflection. This hypothesis was supported by the results of the present study. This finding suggests that brooding may be linked to perceiving oneself to be especially vulnerable to negative affect in times of stress; and/or believing oneself to be especially vulnerable to negative affect in times of stress may encourage brooding. This correlation could help explain why brooding has consistently been associated in prior research with deleterious outcomes, as periods of brooding may coincide with heightened perceptions of vulnerability.

Strengths, Limitations, Future Directions and Clinical Implications

The present study is the first to consider the potential of cognitive inflexibility to coincide with heightened emotional arousal that influences the tendency to brood, and to further examine whether the relation between brooding and suicidal ideation can be explained by engaging in avoidant problem-solving in order to avoid such heightened emotional arousal. It is also the first to examine whether reflective rumination is a buffer against suicidal ideation in the presence of low levels of cognitive inflexibility and emotion reactivity, through a relation mediated by planful problem-solving. Moreover, it is also the first to examine whether reflective rumination is a risk factor for suicidal ideation in the presence of high levels of cognitive inflexibility and low levels of emotion reactivity, through a relation mediated by impulsive problem-solving.

Despite these novel lines of inquiry, the present study has several limitations. First, the present study was cross-sectional, therefore its results cannot predict the potential for change over time. Second, the models tested in the present study were all of less than satisfactory fit, meaning that any significant findings should be interpreted with

43

caution. In addition, most of the present study's hypotheses were unsupported. Other

limitations of the present study include that it recruited exclusively emerging adult

college students, and therefore findings from the present study may not generalize to

other age groups and to individuals who did not attend college. The study sample was

also 75% female meaning the findings may be biased by gender. Well-documented

gender differences exist in suicidal thoughts and behaviors (Centers for Disease Control

and Prevention, 2015a). Additionally, this study recruited a community sample, and this

may limit the generalizability of its findings to clinical populations. Furthermore, the

study recruited a limited number of individuals ($n = 14$; see Table 1) who endorsed

previously engaging in suicidal behavior. This small number prevented performing any

statistical analyses related to suicidal behavior. Thus, the present study's findings may

not generalize well to individuals who have engaged in suicidal behavior including

individuals who died by suicide. The present study also has the methodological limitation

of being based exclusively on self-report measures except for the Wisconsin Card Sorting

Test. Self-report measures are subject to reporting biases including evaluation

apprehension, response set, and errors due to misreading and/or failing to comprehend

survey items.

Future research can address the present study's limitations by sampling clinical

populations, individuals who are not currently college students, and individuals who

never attended college. Given existing data that indicates gender differences in suicidal

thoughts and behaviors, replicating the present study among samples of exclusively male

and female individuals may yield information about potential gendered pathways

regarding cognitive inflexibility, emotion reactivity, depressive rumination subtypes,

social problem-solving styles, and suicidal ideation. Given existing findings that suggest cognitive inflexibility increases with age replicating this study among older adults may also yield useful information regarding the influence of age on cognitive inflexibility's relations with emotion reactivity, depressive rumination subtypes, social problem-solving styles, and suicidal ideation. Additional inquires could also address one of the present study's methodological limitations by employing the Mean Ends Problem-Solving Procedure to circumvent potential reporting biases regarding social problem-solving via administration of this performance-based measure. Future research on cognitive inflexibility's potential association with heightened emotional arousal and depressive rumination may similarly benefit from the addition of measures that are not self-reports to verify self-reported findings. For example, utilizing galvanic skin response to measure emotional arousal (Carlson, 2012), and resting heart rate variability to measure depressive rumination (Williams et al., 2017). Finally, future research could examine models similar to those proposed in this study among individuals who report prior engagement in suicidal behaviors.

Clinical implications include that despite poor model fit in all the tested models brooding predicted avoidant problem-solving and reflection predicted planful problem-solving. Brooding and reflection were also both correlated with emotion reactivity, though reflection was less strongly correlated. Given existing theory, research, and established psychotherapies based on social problem-solving such as Problem-Solving Therapy (Nezu et al., 2013), these findings suggest that reflection may be a less deleterious form of depressive rumination than brooding. This is consistent with some prior research on reflection (Burwell & Shirk, 2007; Crane et al., 2007; Grassia & Gibb,

2009). This suggests that more research is needed to clarify the influence of relations of reflection on suicidal thoughts and behaviors, including consideration of potential third variables and of whether the inconsistent results regarding reflection are related to the level or severity of outcome symptoms. Concerning clinical practice, the present study's findings may suggest that depressive rumination is best discouraged among patients, but that if engagement in it is unavoidable a reflective rumination process oriented towards a planful problem-solving style may be less harmful than a brooding rumination process oriented towards identifying negative emotions and avoiding them by utilizing an avoidant problem-solving style.

Table 1.

Summary of Participant Demographics

Category	Subcategory	*n*
Entire Sample		
	All participants	162
Race		
	African American/Black	38
	Asian American or Pacific Islander	25
	European American/White/Caucasian	64
	Native American/American Indian	2
	Mixed Heritage	10
	Other	21
	Refused to Specify a Race	2
Ethnicity		
	Of Hispanic Heritage	47
	Not of Hispanic Heritage	115
Gender		
	Female	122
	Male	39
	Transgendered Female	1
Sexual Orientation		
	Heterosexual	125
	Gay/Lesbian	9
	Bisexual	20
	Asexual	3
	Other	5
Suicidal Thoughts and Behaviors		
	Participants who endorsed experiencing suicidal ideation in the 12 months prior to study participation	55
	Participants with one or more prior suicide attempts	14

Table 2.

Means and Standard Deviations of Study Variables

Variable	Mean	Standard Deviation
Brooding	11.62	3.58
Reflection	10.77	3.80
ERS	30.91	18.36
WISC	9.04	4.26
PPS	12.59	4.06
IPS	4.91	3.24
APS	5.54	4.43
BDI	13.97	10.99
BHS	4.50	4.78
SBQ-R	1.75	1.25

Notes. ERS = Emotion Reactivity Scale Total Score; WISC = Wisconsin Card Sorting Test - Perseverative Error Score; PPS = Planful Social Problem-Solving Style; IPS = Impulsive Social Problem-Solving Style; APS = Avoidant Social Problem-Solving Style; BDI = Beck Depressive Inventory - II; BHS = Beck Hopelessness Scale; SBQ-R = Suicidal Ideation over the 12 Months prior to participation assessed by item 2 of the Suicide Behaviors Questionnaire - Revised.

Table 3.
Correlations between Study Variables

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Brooding	-									
2. Reflection	.56***	-								
3. ERS	.68***	.41***	-							
4. WISC	.04	.06	.10	-						
5. PPS	-.07	.17*	-.04	.040	-					
6. IPS	.23**	.08	.26**	.07	-.30***	-				
7. APS	.40***	.27**	.46***	.07	-.35***	.41***	-			
8. BDI	.64***	.57***	.58***	-.03	-.18*	.21**	.52***	-		
9. BHS	.47***	.32***	.41***	-.14	-.28***	.15	.48***	.69***	-	
10. SBQ-R	.50***	.43***	.42***	-.05	-.18*	.23**	.44**	.72***	.67***	-

Notes. * $p < .05$, ** $p < .01$, *** $p < .001$; - = a correlation of 1; ERS = Emotion Reactivity Scale Total Score; WISC = Wisconsin Card Sorting Test - Perseverative Error Score; PPS = Planful Social Problem-Solving Style; IPS = Impulsive Social Problem-Solving Style; APS = Avoidant Social Problem-Solving Style; BDI = Beck Depressive Inventory - II; BHS = Beck Hopelessness Scale; SBQ-R = Suicidal Ideation over the 12 Months prior to participation assessed by item 2 of the Suicide Behaviors Questionnaire - Revised.

Table 4.

Summary of Model 1 as Proposed

Block/Variable	R^2	Adj. R^2	ΔR^2	B	S.E.	β	Partial r	p-value
Block 1	0.58	0.57	0.58					
BDI				**0.06**	**0.01**	**0.50**	**0.49**	**<.001**
BHS				**0.08**	**0.02**	**0.32**	**0.34**	**<.001**
Block 2	0.59	0.56	0.01					
BDI				**0.05**	**0.01**	**0.45**	**0.37**	**<.001**
BHS				**0.09**	**0.02**	**0.33**	**0.33**	**<.001**
Brooding				0.01	0.03	0.03	0.03	.726
Reflection				0.02	0.02	0.06	0.07	.399
ERS				0.00	0.01	-0.04	-0.04	.593
WISC				0.00	0.02	0.00	0.00	.986
PPS				0.00	0.02	0.01	0.02	.847
IPS				0.03	0.02	0.09	0.12	.151
APS				0.00	0.02	0.00	0.01	.947

Notes. Significant Predictors are **bolded**; *Adj.* = Adjusted; Δ = Change in; *B* = Unstandardized regression coefficient; *S.E.* = Standard Error; *β* = Standardized regression coefficient; BDI = Beck Depressive Inventory - II; BHS = Beck Hopelessness Scale; ERS = Emotion Reactivity Scale Total Score; WISC = Wisconsin Card Sorting Test - Perseverative Error Score; PPS = Planful Social Problem-Solving Style; IPS = Impulsive Social Problem-Solving Style; APS = Avoidant Social Problem-Solving Style; f^2 = .02.

Table 5.

Summary of Model 2 as Proposed

Path	Variable 1	-->	Variable 2	*B*	*SE*	*p-value*
A paths from depressive rumination subtypes to problem-solving styles	**Brooding**	**-->**	**APS**	**0.37**	**0.11**	**.000**
	Reflection	**-->**	**PPS**	**0.23**	**0.07**	**.002**
	Reflection	-->	IPS	0.03	0.07	.608
B paths from problem-solving styles to suicidal ideation	APS	-->	SBQ-R	0.00	0.02	.969
	PPS	-->	SBQ-R	0.00	0.02	.899
	IPS	-->	SBQ-R	0.03	0.02	.148
C paths from depressive rumination subtypes to suicidal ideation	Brooding	-->	SBQ-R	0.00	0.03	.909
	Reflection	-->	SBQ-R	0.02	0.03	.412
Covariates	**BDI**	**-->**	**SBQ-R**	**0.05**	**0.01**	**.000**
	BHS	**-->**	**SBQ-R**	**0.09**	**0.03**	**.001**

Notes. Significant pathways are **bolded**. *B* = Unstandardized coefficient; *SE* = Standard Error; APS = Avoidant Social Problem-Solving Style; PPS = Planful Social Problem-Solving Style; IPS = Impulsive Social Problem-Solving Style; SBQ-R = Suicidal Ideation over the past 12 Months assessed by item 2 of the Suicide Behaviors Questionnaire – Revised; BDI = Beck Depressive Inventory - II; BHS = Beck Hopelessness Scale.

Table 6.
Summary of Model 3 as Proposed

Path	Variable 1	-->	Variable 2	*B*	*SE*	*p-value*
A paths from depressive rumination subtypes to problem-solving styles	**Brooding**	**-->**	**APS**	**0.37**	**0.11**	**.001**
	Brooding X WISC	-->	APS	-0.01	0.03	.705
	Brooding X ERS	-->	APS	0.00	0.01	.948
	Reflection	**-->**	**PPS**	**0.23**	**0.08**	**.002**
	Reflection X WISC	-->	PPS	0.01	0.02	.477
	Reflection X ERS	-->	PPS	0.00	0.00	.568
	Reflection	-->	IPS	0.03	0.07	.637
	Reflection X WISC	-->	IPS	0.01	0.02	.497
	Reflection X ERS	-->	IPS	0.00	0.01	.952
B paths from problem-solving styles to suicidal ideation	APS	-->	SBQ-R	0.00	0.02	.968
	PPS	-->	SBQ-R	0.00	0.02	.902
	IPS	-->	SBQ-R	0.03	0.02	.159
C paths from depressive rumination subtypes to suicidal ideation	Brooding	-->	SBQ-R	0.00	0.03	.909
	Reflection	-->	SBQ-R	0.02	0.03	.416
Covariates	**BDI**	**-->**	**SBQ-R**	**0.05**	**0.01**	**.000**
	BHS	**-->**	**SBQ-R**	**0.09**	**0.03**	**.001**

Notes. Significant pathways are **bolded**. *B* = Unstandardized coefficient; *SE* = Standard error; APS = Avoidant Social Problem-Solving Style; WISC = Wisconsin Card Sorting Test - Perseverative Error Score; ERS = Emotion Reactivity Scale Total Score; PPS = Planful Social Problem-Solving Style; IPS = Impulsive Social Problem-Solving Style; SBQ-R = Suicidal Ideation over the past 12 Months assessed by item 2 of the Suicide Behaviors Questionnaire – Revised; BDI = Beck Depressive Inventory - II; BHS = Beck Hopelessness Scale.

Table 7.
Summary of Model 4 as Proposed

Path	Variable 1	-->	Variable 2	*B*	*SE*	*p-value*
A paths from depressive rumination subtypes to problem-solving styles	**Brooding**	**-->**	**APS**	**0.37**	**0.11**	**.001**
	Brooding X WISC X ERS	-->	APS	-0.01	0.03	.683
	Reflection	**-->**	**PPS**	**0.23**	**0.08**	**.003**
	Reflection X WISC X ERS	-->	PPS	0.01	0.02	.540
	Reflection	-->	IPS	0.03	0.06	.603
	Reflection X WISC X ERS	-->	IPS	0.01	0.02	.495
B paths from problem-solving styles to suicidal ideation	APS	-->	SBQ-R	0.00	0.03	.970
	PPS	-->	SBQ-R	0.00	0.02	.898
	IPS	-->	SBQ-R	0.03	0.02	.145
C paths from depressive rumination subtypes to suicidal ideation	Brooding	-->	SBQ-R	0.00	0.03	.908
	Reflection	-->	SBQ-R	0.02	0.03	.435
Covariates	**BDI**	**-->**	**SBQ-R**	**0.05**	**0.01**	**.000**
	BHS	**-->**	**SBQ-R**	**0.09**	**0.03**	**.001**

Notes. Significant pathways are **bolded**. *B* = Unstandardized coefficient; *SE* = Standard error; APS = Avoidant Social Problem-Solving Style; WISC = Wisconsin Card Sorting test - Perseverative Error Score; ERS = Emotion Reactivity Scale Total Score; PPS = Planful Social Problem-Solving Style; IPS = Impulsive Social Problem-Solving Style; SBQ-R = Suicidal Ideation over the past 12 Months assessed by item 2 of the Suicide Behaviors Questionnaire – Revised; BDI = Beck Depressive Inventory - II; BHS = Beck Hopelessness Scale.

Table 8.
Comparative Summary of Proposed Model Fit Indices

Model	χ^2	d.f.	$\chi^2/d.f.$	p-value	CFI	TFI	RMSEA	SRMR	AIC
1	-	-	-	-	-	-	-	-	-
2	54.59	9	6.07	**<.001**	.83	.58	.18	.13	3033
3	206.21	44	4.69	**<.001**	.70	.38	.15	.15	5382
4	196.96	35	5.63	**<.001**	.57	.38	.17	.16	5376

Notes. Significant Model Chi-Square *p-values* are **bolded;** - = Model fit statistics were unavailable for Model 1 as it was a multiple linear regression and not a path analysis; χ^2 = Model Chi-Square statistic; *d.f.* = Degrees of Freedom for Model Chi-Square statistic; *p-value* = *p-value* for Model Chi-Square statistic; CFI = Comparative Fit Index; TFI = Tucker-Lewis Index; RMSEA = The Root Mean Square Error of Approximation; SRMR = The Standardized Root-Mean-Square Residual; AIC = Akaike's Information Criterion.

Figure 1.
Graphical Representation of Model 1 as Proposed
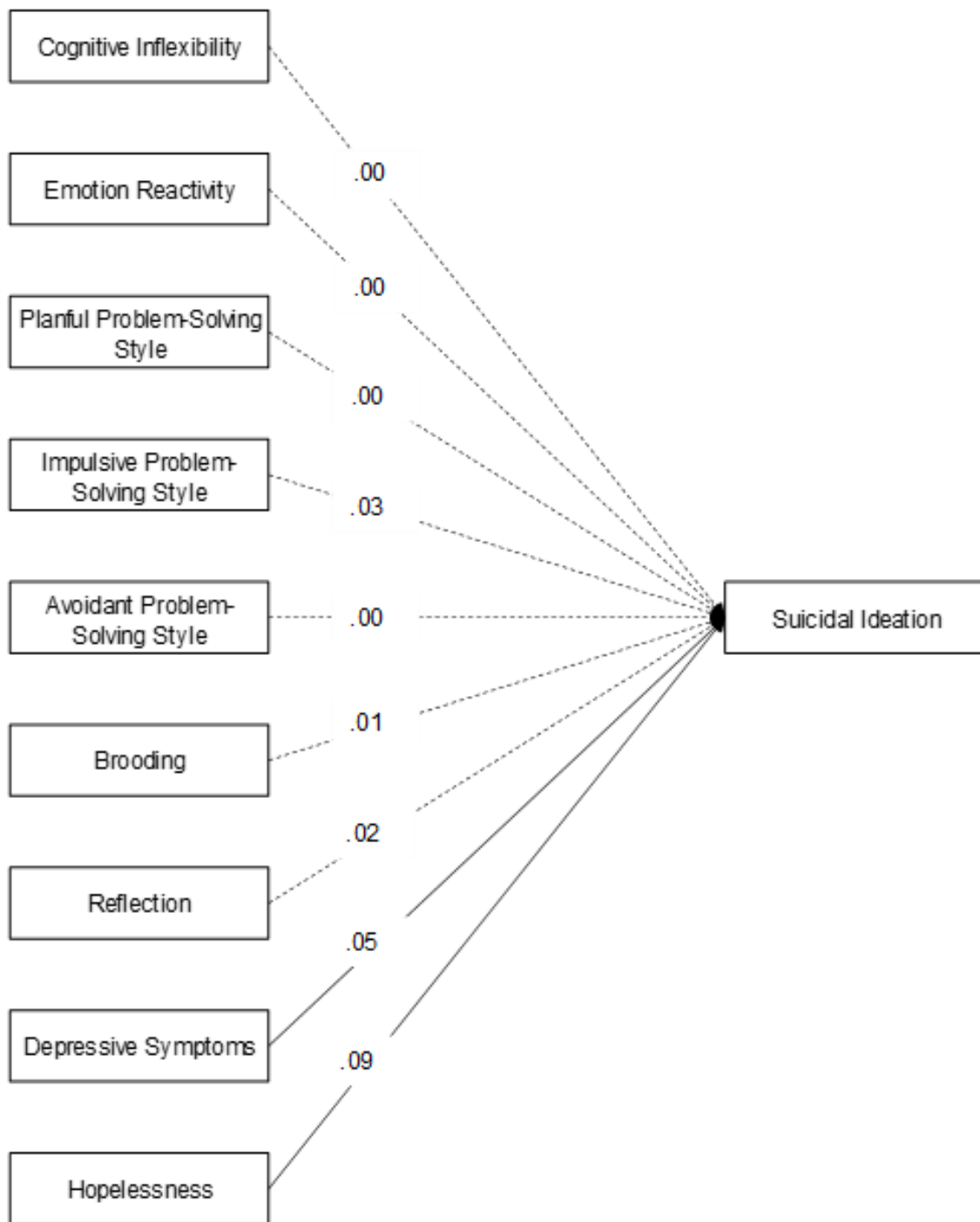
Figure 1. In model 1 all study variables were direct predictors of suicidal ideation.

Dotted lines indicate non-significant pathways.

Figure 2.
Graphical Representation of Model 2 as Proposed
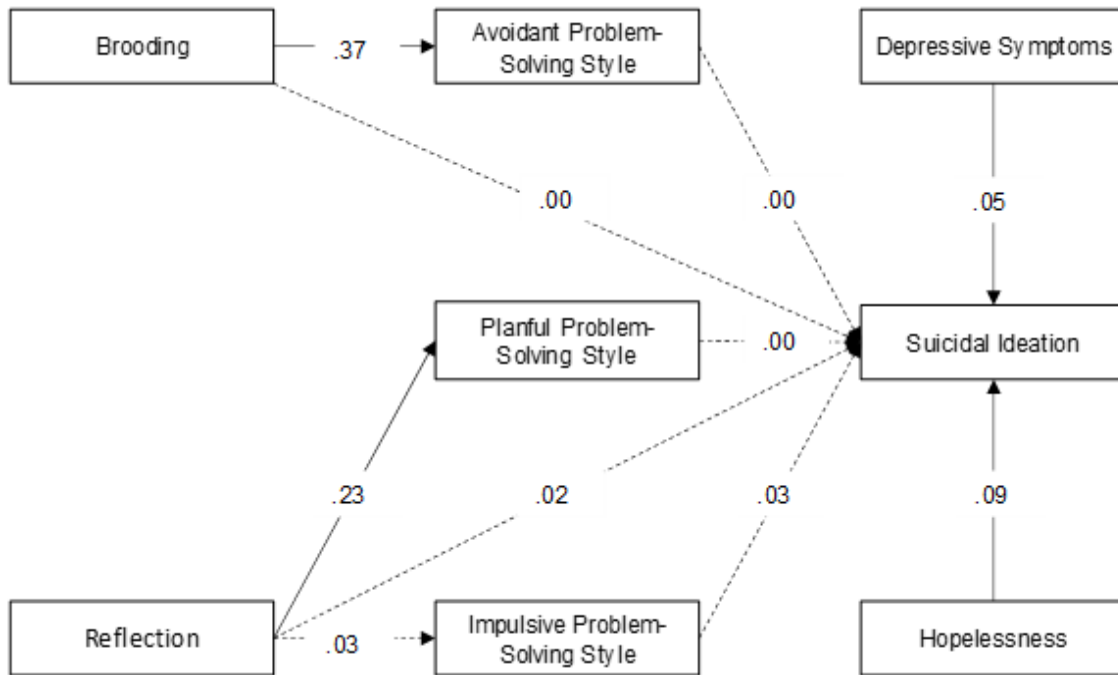
Figure 2. In model 2 reflection predicted suicidal ideation through the planful and

impulsive problem-solving styles; and brooding predicted suicidal ideation through the

avoidant problem-solving style. Dotted lines indicate non-significant pathways.

Figure 3.
Graphical Representation of Model 3 as Proposed
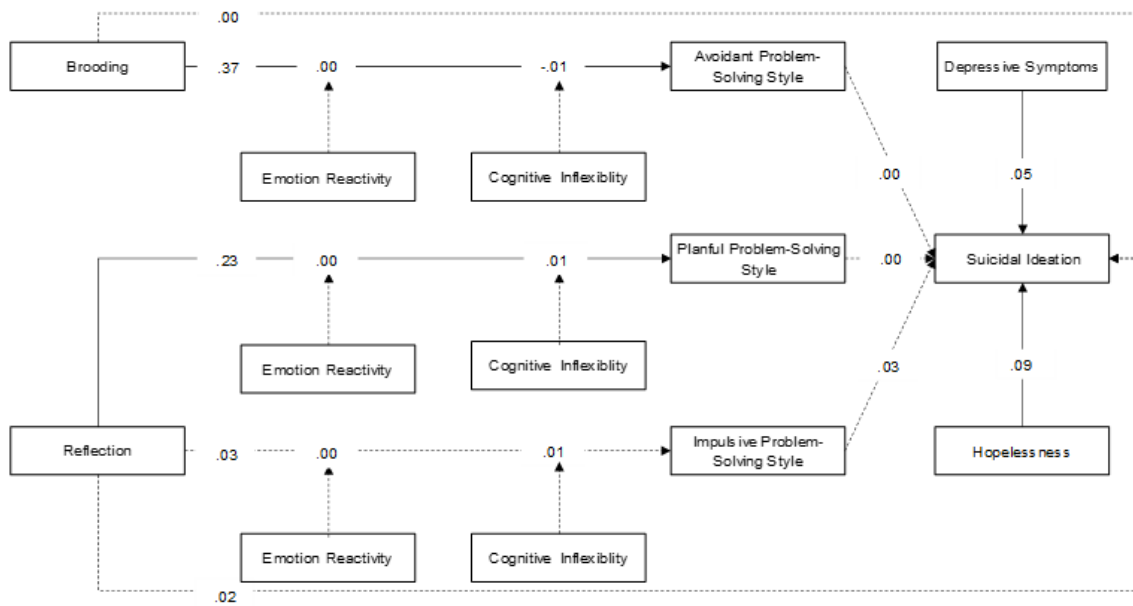
Figure 3. In model 3, reflection predicted suicidal ideation through the planful and impulsive problem-solving styles; and brooding predicted suicidal ideation through the avoidant problem-solving style. Cognitive inflexibility and emotion reactivity acted as separate moderators of the influence of depressive rumination subtypes on the relations between depressive ruminative subtypes and problem-solving styles. Dotted lines indicate non-significant pathways. The leftmost coefficients for the influence of Brooding and Reflection on problem-solving styles are without the influence of moderators.

Figure 4.
Graphical Representation of Model 4 as Proposed
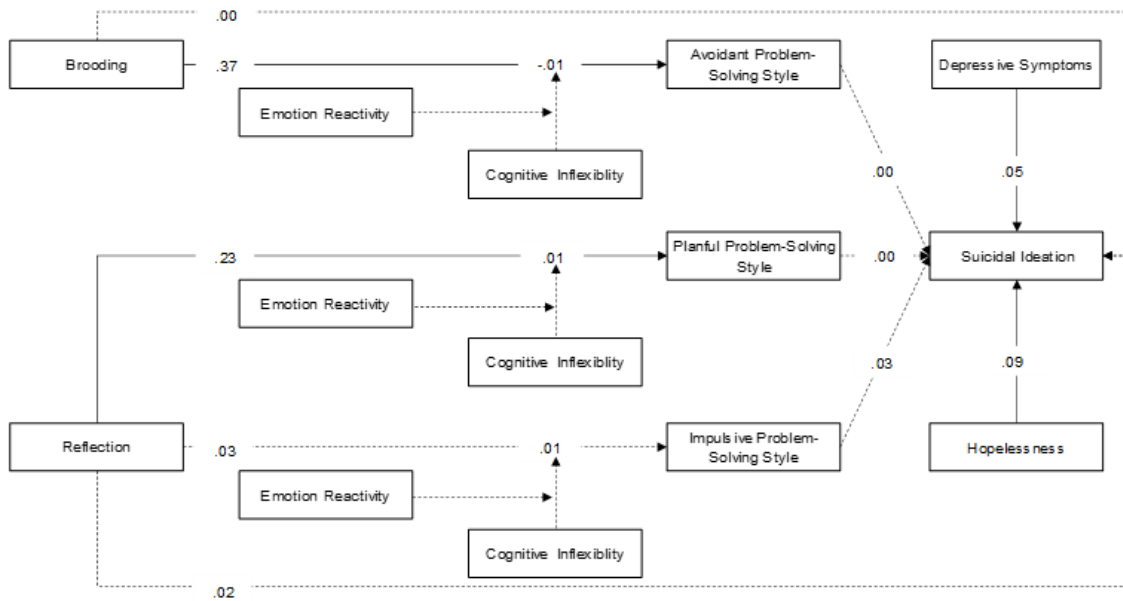
Figure 4. In model 4, reflection predicted suicidal ideation through the planful and

impulsive problem-solving styles; and brooding predicted suicidal ideation through the

avoidant problem-solving style. In addition, emotion reactivity was hypothesized to

moderate cognitive inflexibility's influence as a moderator of the relations between

depressive rumination subtypes and problem-solving styles. Dotted lines indicate non-

significant pathways. The leftmost coefficients for the influence of Brooding and

Reflection on problem-solving styles are without the influence of moderators.

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