

Measuring basic needs satisfaction: Evaluating previous research and conducting new psychometric evaluations of the Basic Needs Satisfaction in General Scale

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ABSTRACT

Self-Determination Theory specifies the existence of three basic psychological needs: autonomy, competence, and relatedness. The current set of studies (a) provides a narrative review of past research on the Basic Needs Satisfaction in General Scale, (b) examines its dimensionality which has been assumed but not empirically studied, and (c) gathers external validity evidence. Confirmatory factor analysis was used to test the existence of a one- and a three-factor solution; neither model fit the data. After patterns of misfit were examined across three independent samples, a reduced, 16-item three-factor model with a negative-worded method effect was championed. External validity evidence, collected by examining the differential relationships between the three needs and measures of well-being and worry, supported the distinctiveness of the three needs. Although the results are promising, future research is needed to examine the generalizability of the psychometric properties of the modified scale.

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1. Introduction

During the past century the theory that humans have basic needs has been developed and expanded by several different theorists. For example, some researchers have theorized needs are innate in humans (e.g., Deci & Ryan, 2000; Hull, 1943), whereas other researchers have theorized needs are learned over time (e.g., McClelland, 1965; Murray, 1938). Furthermore, researchers have differed in regards to what constitutes a need. Some researchers have proposed needs are psychological in nature (e.g., dominance; Murray, 1938), whereas other researchers have proposed needs are physiological in nature (e.g., food; Hull, 1943). In contrast, some theorists have proposed needs are a combination of the both (e.g., Maslow, 1970). Self-Determination Theory (SDT) defines needs as innate, psychological, and essential for well-being (Deci & Ryan, 2000).

1.1. Basic needs according to Self-Determination Theory

SDT postulates the existence of three basic needs: autonomy, competence, and relatedness.¹ Autonomy refers to the need to feel that one's behavior and resulting outcomes are self-determined, or self-caused, as opposed to being influenced or controlled by outside forces (deCharms, 1968; Deci & Ryan, 1985, 2000). Competence refers to the need to feel effective and capable of performing tasks at varying levels of difficulty (Harter, 1978; Ryan & Deci, 2002; White, 1959). Relatedness refers to the need to feel connected to, supported by, or cared for by other people (Baumeister & Leary, 1995; Ryan & Deci, 2002). SDT stipulates *all three needs* must be fulfilled for psychological well-being to occur (Deci & Ryan, 2000). That is, if only one or two of the three needs are fulfilled psychological health will suffer (Deci & Ryan, 2000; Ryan, 1995).

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¹ Although SDT currently postulates the existence of three basic psychological needs, it is important to note there may exist more. However, autonomy, competence, and relatedness are currently the only three needs that adhere to the criterion of needs as defined by SDT (i.e., required for psychological well-being and growth; Ryan & Deci, 2000c). For instance, several needs previously hypothesized by other theories (e.g., achievement and self-esteem) are not considered needs by SDT because they do not directly impact psychological well-being; they are considered desires (Baard, Deci, & Ryan, 2004; Ryan & Deci, 2000c). Furthermore, these desires are often detrimental or entail negative consequences to an individual rather than increase well-being (Ryan & Brown, 2003). For more information regarding this discussion, please refer to Deci and Ryan (2000), Ryan and Deci (2000c) and Ryan and Brown (2003).

In addition to being important for psychological well-being, according to the sub-theories of SDT, Cognitive Evaluation Theory (CET) and Organismic Integration Theory (OIT), needs satisfaction is also crucial for psychological growth (Deci & Ryan, 2000; Ryan & Deci, 2000a, 2002). According to CET, the fulfillment of basic needs (autonomy and competence in particular) has a direct, positive influence on intrinsic motivation (i.e., performing an activity for inherent interests and pleasure; Deci & Ryan, 1985; Ryan & Deci, 2000a, 2002). That is, feelings of being controlled by external forces or being ineffective regarding the task at hand will undermine levels of intrinsic motivation and will result in being controlled by external criteria, such as a pay check or a superior's approval (Deci & Ryan, 1985, 2000; Ryan & Deci, 2000a). Moreover, according to OIT, psychological growth (becoming more autonomous in behaviors performed), aids in the creation of a "unified sense of self", or a person who successfully interacts with the social environment and others (Ryan & Deci, 2002, p. 5). Specifically, growth occurs with the integration and internalization of ideas or behaviors formerly motivated by extrinsic forces, or the acceptance and valuing of behaviors initially performed for external reasons (Ryan, 1995; Ryan & Deci, 2002). However, according to OIT, this will only occur when the needs of autonomy, competence, and relatedness are met (Ryan & Deci, 2000b, 2002).

Satisfaction of the basic needs for autonomy, competence, and relatedness has been positively related to well-being (e.g., Reis, Sheldon, Gable, Roscoe, & Ryan, 2000; Sheldon & Niemiec, 2006), satisfaction with life (e.g., Meyer, Enstrom, Harstveit, Bowles, & Beevers, 2007), aspirations (e.g., Niemiec, Ryan, & Deci, 2009), and self-esteem (e.g., Thøgersen-Ntoumani & Ntoumanis, 2007) and has been negatively related to depression (e.g., Wei, Philip, Shaffer, Young, & Zakalik, 2005), and anxiety (e.g., Deci et al., 2001).

1.2. The current state of measurement of basic needs satisfaction

Clearly, there has been an extensive amount of research examining needs fulfillment (Deci & Ryan, 2000). However, less attention has been paid to *how* needs satisfaction is being measured. The satisfaction of needs has been measured using various methods (e.g., self-report measures and diary studies) and in various settings. The satisfaction of basic needs has been primarily measured in context-specific settings such as work (e.g., Deci et al., 2001) and relationships (e.g., La Guardia, Ryan, Couchman, & Deci, 2000). Recently a measure was created to assess basic needs satisfaction in general as opposed to a specific context: the Basic Needs Satisfaction in General Scale (BNSG-S²; Gagné, 2003).

The BNSG-S has been used in several studies to assess general needs satisfaction (Conroy & Coatsworth, 2007a, 2007b; Gagné, 2003; Kashdan, Julian, Merritt, & Uswatte, 2006; Kashdan, Mishra, Breen, & Froh, 2009; Meyer et al., 2007; Neff, 2003; Niemiec et al., 2009; Thøgersen-Ntoumani & Ntoumanis, 2007; Vansteenkiste, Lens, Soenens, & Luyckx, 2006; Wei et al., 2005). Given its use, one may assume the BNSG-S has been extensively studied. Interestingly, there has not been any rigorous study of the psychometric properties of the scale. That is, there are no known factor analytic studies of the BNSG-S (E. Deci, personal communication, July 1, 2008; M. Vansteenkiste, personal communication, July 3, 2008). Unfortunately, this makes it difficult to make valid inferences from the scale as it is unknown what the BNSG-S is truly assessing. Thus, studies examining the psychometric properties of this measure are needed.

1.3. Following a strong program of construct validation to evaluate the BNSG-S

In order to evaluate the BNSG-S, the framework for validity explained by Benson (1998) will be used to organize existing infor-

mation about the scale. Benson (1998) outlined three stages required to establish a strong program of construct validity: substantive, structural, and external (see also Benson & Hagtvet, 1996). The first stage (substantive) refers to the process of defining the theoretical and empirical domains of the construct of interest. Specifically, the theoretical domain is representative of all information known about the construct; it is the "scientific theory surrounding the construct" (Benson, 1998, p. 12). The empirical domain is representative of all observed variables that are used to represent the construct. Thus, the theoretical domain should be broadly defined, whereas the empirical domain is more specific in nature but a function of the theoretical domain. The second stage (structural) involves examining the interrelationships between the observed variables (e.g., the items). Correlations, internal consistency, and factor analysis are often assessed at this step. The third stage (external) involves examining if the construct is related to external constructs in theoretically expected ways. This is considered the most essential stage because it provides information regarding the nomological network of the construct. Using Benson's strong program of construct validation as a framework, the BNSG-S is evaluated below.

1.3.1. Substantive stage

The BNSG-S was adapted from the Basic Needs Satisfaction at Work Scale (BNSW-S²) to measure needs satisfaction in a general domain as opposed to the context-specific domain of work (Gagné, 2003). The items from the BNSW-S were slightly modified to measure needs satisfaction in a general context. For example, the BNSW-S item "Most days I feel a sense of accomplishment from working", which was written to measure the satisfaction of the need for competence at work, was changed to "Most days I feel a sense of accomplishment from what I do" to measure the satisfaction of the need for competence in general (see Appendix A for the BNSG-S items). Given that the BNSG-S was simply an adaptation from the BNSW-S, it is important to review the theoretical and empirical domains of the BNSW-S.

The BNSW-S was created to assess the satisfaction of employees' basic needs in the workplace (Kasser, Davey, & Ryan, 1992). Specifically, the BNSW-S was constructed by merging some new items based on "theoretical notions" (Kasser et al., 1992, p. 180) with some modified items from the perceived-competence subscale of the Intrinsic Motivation Inventory (IMI; Ryan, 1982).² At the time of the creation of the BNSW-S, the IMI consisted of at least four subscales that included perceived-competence, interest-enjoyment, effort, and pressure-tension. An example of an item from the perceived-competence subscale is: "I think I am pretty good at this activity". This and other items from the perceived-competence subscale of the IMI were simply reworded and modified to be specific to a work setting for the BNSW-S. Items from the other IMI subscales were not used to create BNSW-S items. The modified items from the IMI and the newly written items based on needs satisfaction theory appear to adequately represent the empirical domain of assessing the satisfaction of needs at work.

1.3.2. Structural stage

Unfortunately, similar to the BNSG-S, there are no known studies that have examined the factor structure of the BNSW-S. As such, there is no empirical evidence of the dimensionality of either measure and, in turn, there appears to be confusion regarding how to score the responses to the measures. Specific to the BNSG-S, some researchers have used a total score of general needs satisfaction

² The BNSG-S, BNSW-S, and IMI were retrieved from the website, <http://www.psych.rochester.edu/SDT/questionnaires.php>, which is maintained by E. Deci and R. Ryan from the University of Rochester. It should be noted that the website is subject to change.

(e.g., Gagné, 2003), whereas others have computed three subscales to represent three distinct needs (e.g., Niemiec et al., 2009). Similarly, specific to the BNSW-S, some researchers have created a total score of needs satisfaction at work (e.g., Deci et al., 2001), whereas other researchers have created three subscale scores to represent the three distinct needs of autonomy, competence, and relatedness (e.g., Ghorbani & Watson, 2006). Furthermore, for both the BNSG-S and the BNSW-S, some researchers who have created a total score of needs satisfaction have also created individual subscale scores to represent the three distinct needs (e.g., Gagné, 2003). Researchers have assumed validity, versatility, and flexibility of the scale, and have stated it can be scored either way (E. Deci, personal communication, June 12, 2008). These beliefs appear to be due in part to researchers erroneously citing others studies to support their use and scoring of the BNSG-S. For example, authors have claimed the BNSG-S has “excellent psychometric properties” and cited Gagné (2003) in support (Kashdan et al., 2006, p. 565). Although, Gagné (2003) used the BNSG-S to study general needs, she did not examine the psychometric properties of the BNSG-S. In addition, researchers have also erroneously cited studies which used the BNSW-S to provide psychometric evidence of the properties of the BNSG-S. For example, Neff (2003) cited two studies (i.e., Ilardi, Leone, Kasser, & Ryan, 1993; Kasser et al., 1992) as providing good psychometric evidence of the BNSG-S; however both studies cited used older versions of the BNSW-S, not the BNSG-S. This is problematic because the BNSW-S and the BNSG-S are two different measures and do not provide evidence of dimensionality for one another.

For the BNSG-S, the only sources of information regarding the structural component of the validity process are in the form of reliability coefficients and subscale correlations, not in the form of factor analytic studies, which according to Benson and Hagtvet (1996), “would provide evidence whether the observables (e.g., the items) behave according to theory” (p. 91). Reported measures of internal consistency associated with a total needs satisfaction score ranged from .84 to .90 (Gagné, 2003; Meyer et al., 2007; Vansteenkiste et al., 2006; Wei et al., 2005). With respect to the three subscales computed from the BNSG-S scores, researchers reported values of internal consistency ranging from .61 to .81 for the autonomy subscale, .60 to .86 for the competence subscale, and .61 to .90 for the relatedness subscale (Conroy & Coatsworth, 2007a, 2007b; Gagné, 2003; Kashdan et al., 2006, 2009; Meyer et al., 2007; Niemiec et al., 2009; Thøgersen-Ntoumani & Ntoumanis, 2007; Vansteenkiste et al., 2006; Wei et al., 2005). It is important to note that Cronbach’s coefficient alpha is only appropriate to interpret when researchers are confident there is only one construct or phenomenon being measured; that is, the scores are unidimensional (McDonald, 1999). Therefore, it is confusing when researchers (i.e., Gagné, 2003; Meyer et al., 2007; Wei et al., 2005) report measures of internal consistency associated with a total needs scale (and use a total score in the analyses) when it was assumed by the same researchers that the scale measures three separate constructs (autonomy, competence, and relatedness). This practice may simply reflect the confusion associated with the dimensionality and scoring of the measure.

Correlations among the three subscales have been examined by researchers and shed some limited light on the distinctiveness of the three needs as operationalized by the BNSG-S. Specifically, correlations between the subscales ranged between $r = .46$ and $.72$ for autonomy and competence, $r = .33$ – $.79$ for autonomy and relatedness, and $r = .27$ – $.80$ for relatedness and competence (Conroy & Coatsworth, 2007a; Gagné, 2003; Kashdan et al., 2009; Meyer et al., 2007; Thøgersen-Ntoumani & Ntoumanis, 2007; Vansteenkiste et al., 2006; Wei et al., 2005). Given the lack of factor analytic studies, researchers may be tempted to infer that the wide range of subscale correlations is evidence to suggest the BNSG-S is not

measuring one overall construct of needs satisfaction, but instead a measure of three different constructs. Furthermore, the differential relationships exhibited between the subscales and external criteria described below could be used as additional evidence to suggest the BNSG-S may be representing multiple constructs.

1.3.3. External stage

Because some studies have scored the BNSG-S as both a total measure of needs satisfaction and three individual needs, whereas other studies have only scored the BNSG-S as three individual needs, and given the individual subscales have exhibited similar and differential relationships with external variables, the following section examines the relationships between the BNSG-S and external variables in three parts. First, the relationships between the total needs satisfaction scores and external variables are examined. Second, the relationships between the individual subscales (autonomy, competence, and relatedness) and external variables of similar strength are reviewed. Finally, the relationships between the individual subscales and external variables of differential strength are reviewed.³

1.3.3.1. Correlations with the total needs satisfaction score. The total BNSG-S score has been positively related to well-being among Chinese college students studying abroad in Denmark (Vansteenkiste et al., 2006), happiness and self-actualization in women who worked as models in Great Britain, happiness, self-actualization, and life satisfaction in women who did not work as models in Great Britain (Meyer et al., 2007), pro-social behavior (i.e., volunteering) and parental support (Gagné, 2003). In contrast, the satisfaction of needs when represented by a total needs score has been negatively related to depression in Chinese college students studying abroad (Vansteenkiste et al., 2006) and anxiety, depression, and loss of confidence in women working as models in Great Britain (Meyer et al., 2007). Thus, the external relationships associated with a total needs satisfaction score appear to support SDT’s definition of needs satisfaction (i.e., higher levels of needs satisfaction are positively related to measures of well-being and negatively related to measures of ill-being).

1.3.3.2. Similar relationships between individual subscale scores and external variables. Relationships of similar strengths have emerged between the three subscales (autonomy, competence, and relatedness) and external variables that serve as proxy measures of well-being. Specifically, satisfaction of the needs for autonomy, competence, and relatedness related positively and at approximately the same magnitude to life satisfaction ($r = .50$, $r = .59$, $r = .57$), self-esteem ($r = .50$, $r = .53$, $r = .41$) and positive affect in American college graduates ($r = .58$, $r = .58$, $r = .46$; Niemiec et al., 2009); life satisfaction ($r = .51$, $r = .49$, $r = .31$) and happiness in British women ($r = .44$, $r = .43$, $r = .36$; Meyer et al., 2007); and psychological well-being ($r = .56$, $r = .58$, $r = .60$) and vitality in Chinese college students ($r = .51$, $r = .58$, and $r = .61$, respectively; Vansteenkiste et al., 2006). In contrast, the individual subscales of autonomy, competence, and relatedness related negatively and at approximately the same magnitude to depression in American college students ($r = -.63$, $r = -.63$, $r = -.62$; Wei et al., 2005); negative affect in male ($r = -.43$, $r = -.55$, $r = -.59$) and female ($r = -.50$, $r = -.50$, $r = -.37$) college students (Kashdan et al., 2009); negative affect ($r = -.46$, $r = -.39$, $r = -.34$) and anxiety ($r = -.47$, $r = -.40$,

³ The correlations between the individual subscale scores and external variables reviewed in Sections 1.3.3.2 and 1.3.3.3 were assessed for statistical differences by the first author of the current manuscript using the Meng, Rosenthal, and Rubin Z-test (Meng, Rosenthal, & Rubin, 1992). All of the relationships presented in this section are significantly different unless otherwise noted (e.g., the correlations of similar magnitude presented in Section 1.3.3.2).

$r = -.35$) in college graduates (Niemic et al., 2009), and the drive for thinness ($r = -.51$, $r = -.46$, $r = -.39$) and introjected regulation in British aerobics instructors ($r = -.29$, $r = -.36$, $r = -.26$, respectively; Thøgersen-Ntoumani & Ntoumanis, 2007). The correlations of similar magnitude between the individual subscales and external variables may be incorrectly used to suggest that the three subscales may not be very distinct from one another. Obviously, the three needs may have equal predictive utility in some situations or for some external variables; thus, findings of this nature do not imply that non-differential relationships will always occur or that theoretically the needs are not distinct.

1.3.3.3. Differential relationships between individual subscale scores and external variables. When scored individually, the three separate subscales of the BNSG-S have exhibited differential relationships with external variables. For instance, the autonomy subscale exhibited a stronger relationship with well-being in British women ($r = .73$) than the need for competence ($r = .52$), although relationships of similar strength emerged between the three subscales and well-being in Chinese college students (Meyer et al., 2007; Vansteenkiste et al., 2006). The need for competence subscale ($r = .60$) exhibited a stronger relationship with positive affect in female college students than the need for autonomy or relatedness subscales ($r = .44$, $r = .39$, respectively; Kashdan et al., 2009). In addition, the need for competence subscale exhibited a stronger relationship with pro-social engagement (i.e., volunteering; $r = .40$) than the autonomy subscale ($r = .19$), but was not different from the relatedness subscale ($r = .26$; Gagné, 2003). The need for relatedness subscale exhibited a stronger negative relationship with depression in Chinese college students ($r = -.61$) than did the need for competence subscale ($r = -.46$; Vansteenkiste et al., 2006). In contrast, the need for relatedness subscale was not correlated with depression in British models although depression was negatively correlated with the need for autonomy and competence subscales (Meyer et al., 2007). Furthermore, the need for relatedness exhibited a weaker relationship with social physique anxiety among British aerobics instructors ($r = -.36$) than the needs for autonomy or competence ($r = -.57$, $r = -.52$, respectively; Thøgersen-Ntoumani & Ntoumanis, 2007).

1.3.3.4. Need for dimensionality studies prior to examining external validity. Researchers who believe the BNSG-S is a unidimensional measure of needs satisfaction may turn to the studies reviewed above that exhibit theoretically-expected relationships between the total score and external variables or similar relationships between the three subscales and external variables as evidence of the unidimensional nature of the BNSG-S (e.g., Vansteenkiste

et al., 2006). As noted above, finding non-differential relationships for one external variable does not imply the needs would not function differentially for a different external variable. Researchers who believe the BNSG-S is a measure of three distinct needs may be tempted to use the studies that exhibited differential relationships between the three subscales and external variables as evidence of the multidimensional nature of the scale (e.g., Neff, 2003). However, it is extremely important to note that the similar and differential relationships exhibited between the individual subscale scores and the external variables could be simply due to the differential reliabilities of the autonomy, competence, and relatedness subscales. That is, reliability coefficients impact the magnitude of relationships between the three subscales and external variables, which could result in relationships appearing more similar or more different than they actually are. In addition, the differential correlations exhibited could be due to sampling error or interactions with different populations and contexts being compared. Thus, the relationships exhibited between the subscale scores and external criteria should not be solely relied onto make judgments regarding the dimensionality of a measure.

In sum, although the external component stage is considered the most important stage (Benson, 1998), it should not be examined until the factor structure of the scale has been studied, because it is unclear how the scores should be computed. If the scale was multidimensional, the use of a total score would mask the differential relationships exhibited between the individual subscale scores and external variables.

1.4. Purpose of the study

Given the importance of needs satisfaction in regards to psychological well-being and growth as defined by SDT, the use of the BNSG-S to assess the satisfaction of needs in general, the confusion regarding how to score the measure, and the dearth of psychometric study of the measure, the purpose of the current study was to investigate the construct validity of the BNSG-S by (a) examining the factor structure of the BNSG-S and (b) investigating the external validity of the scale by estimating theoretically-expected relationships with external variables.

The first purpose involved testing the following models using confirmatory factor analysis (CFA): (a) a one-factor model assessing the unidimensionality of the BNSG-S and (b) a three-factor model representing autonomy, competence, and relatedness (see Fig. 1). It was hypothesized a three-factor model would fit the data significantly and practically better than a one-factor model given (a) SDT stipulates three distinct needs and emphasizes that all three needs must be individually met for wellness and (b) three



Fig. 1. Three-factor model of BNSG-S.

distinct needs appeared to have been operationally defined when the BNSG-S items were created.

The second purpose focused on the relationships between needs satisfaction and theoretically-related variables: (a) psychological well-being, (b) the motive to avoid failure, and (c) anxiety. These variables were chosen based on congruence with SDT's perspective of well-being. Given the three-factor model was hypothesized to be championed, differential relationships were hypothesized between the three needs and external measures; these hypotheses are described below.

1.4.1. Well-being

Researchers often use several different measures to represent well-being (e.g., positive affect, negative affect, and life satisfaction; Diener, Emmons, Larsen, & Griffin, 1985). When measured as a combination of life satisfaction, happiness, and self-actualization, well-being has been positively related to satisfaction of the needs for autonomy and competence in British models, and autonomy, competence, and relatedness in non-models (Meyer et al., 2007). For the current study, three of the six well-being dimensions conceptualized by Ryff (1989) were used: autonomy (AU; i.e., not being influenced by others), environmental mastery (EM; i.e., the ability to shape or create environments that are in line with personal needs), and positive relations with others (PR; i.e., the ability to be in close relationships with others). These dimensions of well-being were chosen because they align with SDT's eudaimonic, as opposed to hedonic, perspective of well-being (Ryan & Deci, 2000c, 2002). That is, well-being is defined "in terms of a fully functioning person" (Ryan & Deci, 2000c, p. 323), as opposed to a person displaying individual pieces of evidence such as "a subjective experience of affect positivity" (Deci & Ryan, 2000, p. 243; Ryan & Deci, 2000c, 2002).

In line with SDT, AU, EM, and PR were expected to be positively related to satisfaction of the needs for autonomy, competence, and relatedness. In addition, AU was expected to exhibit a stronger positive relationship with the satisfaction of the need for autonomy than the satisfaction of the need for competence or relatedness. This differential relationship was expected because AU and the satisfaction of the need for autonomy both assess feelings and attitudes towards autonomy, whereas the satisfaction of the need for competence and relatedness do not. Furthermore, EM was expected to exhibit a stronger positive relationship with the satisfaction of the need for competence than the satisfaction of the need for autonomy or relatedness because as people's confidence in their ability to handle and control surrounding environments increases (i.e., environmental mastery increases), the extent to which they feel capable, or confident (i.e., satisfaction of the need for competence) should also increase. Also, PR was expected to exhibit a stronger positive relationship with satisfaction of the need for relatedness than the need for autonomy or competence because PR and satisfaction of the need for relatedness both address the experience, the need to develop, and the desire to have personal relationships with other people, whereas the satisfaction of the needs for autonomy and competence do not.

1.4.2. Motive to Avoid Failure

The motive to avoid failure (MAF) refers to the extent to which people will avoid situations that induce feelings that failure is a possibility (Hagtvet & Benson, 1997). The MAF has been positively related to measures of worry, emotionalism, anxiety, test-irrelevant thinking, and tension and has been negatively related to competitiveness and self-determination (Elliot & McGregor, 2001; Hagtvet & Benson, 1997). For the current study, Hagtvet and Benson's (1997) unidimensional conceptualization of the MAF was used. The MAF was expected to be negatively related to the satisfaction of the needs for autonomy, competence, and relatedness. As

individuals decrease in the degree to which their needs are satisfied, their desire to avoid failure increases. More specifically, it was hypothesized that the MAF would exhibit a stronger negative relationship with satisfaction of the need for competence than with the needs for autonomy or relatedness. That is, people who feel competent at performing tasks should also not feel the need to avoid situations in which failure is a possibility.

1.4.3. Anxiety

Anxiety refers to feelings of worry and restlessness. When measured in general and with respect to one's physical appearance, anxiety has been negatively related to satisfaction of the needs for autonomy, competence, and relatedness (Niemiec et al., 2009; Thøgersen-Ntoumani & Ntoumanis, 2007). For the current study, three of the six dimensions of worry as conceptualized by Osman et al. (2001) were used to assess anxiety and worry: general anxiety symptoms (GAS), worrisome thinking (WST), and social adequacy concern (SAC). The three subscales of autonomy, competence, and relatedness were expected to be negatively related to the GAS, WST, and SAC subscales. In addition, the GAS and WST subscales were expected to exhibit a stronger negative relationship with the satisfaction of the need for autonomy subscale than the satisfaction of the need for competence or relatedness subscales because both constructs reflect a feeling of being controlled by anxiety (e.g., "I feel physically tired and exhausted when worrying about things", "No matter how hard I try, I cannot stop or control worrying about something."). SAC was expected to exhibit a stronger negative relationship with satisfaction of the need for relatedness than to the need for autonomy or competence. This differential relationship was expected because SAC is specific to worrying about relationships and behavior around other people (e.g., "I worry about making a fool of myself around other people."); if people felt cared for and supported by other people (i.e., need for relatedness was satisfied), they should not worry about their social behavior.

2. Methods

2.1. Participants and procedures

Three independent samples of students were used for this set of studies and each is described below: freshmen sample, upperclassmen sample, and psychology sample. All three data sets were screened for missing data, out of range responses, and multivariate outliers.

2.1.1. Participants and procedures for freshmen and upperclassmen samples

The first two samples consisted of students enrolled at a mid-sized southeastern university who participated in one of two university-wide assessment days. All students are required to participate in two university-wide assessment days on campus: once in the fall as incoming freshmen, prior to the beginning of classes, and once in the spring after accumulating 45–70 credit hours (this may include students who are sophomores or juniors). On assessment day, students were randomly assigned to testing rooms on campus, which were monitored by trained proctors. The size of the testing rooms varied. On average 80 students were tested in each room; some rooms tested over 150 students. After providing informed consent, students received a series of tests that were designed to assess their cognitive (i.e., general education) and non-cognitive (i.e., motivational) skills and attitudes. Before receiving each test, students were read a standardized script of the test instructions. Overall, testing sessions took approximately three hours to complete. The BNSG-S was administered approximately

half-way through the testing sessions in the fall of 2007 (freshmen sample) and the spring of 2008 (upperclassmen sample). The usable sample sizes (after screening the data) from the freshmen and upperclassmen samples were 2598 and 1035 students. Participants from the freshmen sample had an average age of 18.43 years, 63.5% were female, and 83.1% were Caucasian. Participants from the upperclassmen sample had an average age of 20.26 years, 60.1% were female, and 79.9% were Caucasian.

2.1.2. Participants and procedures for psychology sample

The third sample consisted of students enrolled in undergraduate psychology courses at a mid-sized southeastern university. Students recruited through the undergraduate psychology subject pool received course credit for participating. A maximum of 50 participants were tested per session.

The data collection procedures were identical for all students. At the beginning of each testing session, students were read a script that detailed the purpose of the study and were told that participation in the study was voluntary. After providing informed consent, students were passed a packet containing a series of tests to be administered. To help insure students took their time on each test and put forth their best effort, tests were administered one at a time, and students were not allowed to proceed to the next test until everyone had finished the previous one. Directions for each test and the expected amount of time for completion were read prior to each administration. Given the BNSG-S was the primary scale of interest in the study, it was the first test administered in each testing session. Following administration of the BNSG-S, students completed three external measures (only administered in the psychology sample) which were used to investigate the external validity of the BNSG-S; these measures were counterbalanced during administration to reduce potential confounds such as test fatigue. The sample size for the psychology sample (after screening the data) was 492 students. The participants had an average age of 19.41 years, 69.2% were female, and 84.5% were Caucasian.

2.2. Measures

2.2.1. Basic Needs Satisfaction in General Scale (BNSG-S)

The BNSG-S is a 21-item measure that was created to assess the satisfaction of basic psychological needs in general (see Appendix A for items). Participants were instructed to indicate how true they felt each statement was of their life and respond on a scale of 1 (*Not at all true*) to 7 (*Very true*). Nine of the 21 items are negatively worded and were reversed scored prior to analyses. Higher scores are indicative of a higher level of satisfaction of needs.

2.2.2. Scales of Psychological Well-Being (SPWB; Ryff, 1989)

The SPWB is a 54-item multidimensional measure used to assess well-being in general. Of the 54 items on the scale, 28 items are negatively worded and were reversed scored prior to obtaining scale scores. Subscale items were summed to create subscale scores; thus, higher scores on the subscales are indicative of higher levels of each dimension of well-being. Although there are six subscales, the current study focused on only three: autonomy (AU), environmental mastery (EM), and positive relations with others (PR). Participants were asked to indicate the degree to which each item reflected how they felt about their life and to respond accordingly on a scale of 1 (*Strongly Disagree*) to 6 (*Strongly Agree*). An example of an item from the AU subscale is “My decisions are not usually influenced by what everyone else is doing.” An example of an item from the EM subscale is “I am quite good at managing the many responsibilities of my daily life”; and an example of an item from the PR subscale is “I often feel lonely because I have few close friends with whom to share my concerns.” Previous research examining the factor structure of the SPWB has generally

supported the six-factor structure hypothesized by Ryff (1989). Cronbach's alphas in the current study for the AU, EM, and PR subscales were respectively, .81, .79, and .83.

2.2.3. Motive to Avoid Failure (MAF; Hagtvet & Benson, 1997)

The MAF is a unidimensional six-item self-report measure that assesses the extent to which individuals experience negative reactions to, or avoid, settings in which failure is a possibility. Participants were instructed to indicate the extent to which they agreed with the items on the scale of 1 (*Almost never*) to 4 (*Almost always*). Scale scores were computed by summing all of the items within the scale. Higher scores are indicative of higher levels of a motive to avoid failure. An example of an item from the scale is, “I dislike working in situations if I'm uncertain of how well I will do”. Previous research has supported the unidimensionality of the scale (Hagtvet & Benson, 1997). Cronbach's alpha in the current study was .87.

2.2.4. Student Worry Questionnaire (SWQ; Osman et al., 2001)

The SWQ is a multidimensional 30-item measure used to assess student-related worry. Although the entire scale was administered, the current study focused on three of the six subscales: worrisome thinking (WST), social adequacy concern (SAC), and general anxiety symptoms (GAS). An example of an item from the WST subscale is “I worry a lot about many daily life events and situations.” An example of an item from the SAC subscale is “I worry about what other people think of me”; and an example of an item from the GAS subscale is “I feel restless or irritable when I worry about things.” Participants were asked to rate how characteristic each item was of themselves on a scale of 1 (*Almost never characteristic of me*) to 5 (*Almost always characteristic of me*). Subscale scores were computed by summing item responses. Higher scores are indicative of higher levels of that particular subscale. Results from previous research examining the factor structure of the SWQ have supported the six-factor structure (Osman et al., 2001; Swerdzewski, 2008). Cronbach's alphas in the current study were the following for WST, SAC, and GAS, respectively: .90, .82, and .85.

3. Results

Descriptive statistics of the BNSG-S items and item correlations for the freshmen and upperclassmen samples, including values of skewness and kurtosis, are presented in Table 1. Descriptive statistics of the BNSG-S items and item correlations for the psychology sample are presented in Table 2. All three data sets were screened for multicollinearity and univariate and multivariate normality. Results of the data screening procedures revealed all three samples violated the assumption of multivariate normality. Specifically, the freshmen, upperclassmen, and psychology samples exhibited Maridia's standardized values of multivariate kurtosis greater than 3 (108.75, 59.63, and 42.92, respectively; Bentler & Wu, 2003).

3.1. Phase one of analysis: confirmatory factor analyses

All CFAs were performed using LISREL 8.72 (Jöreskog & Sörbom, 2005). PRELIS 2.72 (Jöreskog & Sörbom, 2005) was used to generate the covariance matrices from which the models were estimated. Because the assumption of multivariate normality was violated for all three samples, the Satorra–Bentler (SB) scaling method (Satorra & Bentler, 1994) was used in conjunction with maximum likelihood (ML) estimation. Specifically, the SB scaling method was used to adjust the χ^2 statistic, standard errors, and fit indices for the amount of multivariate kurtosis in the data, thus yielding less

Table 1
Correlations and descriptive statistics for the BNSG-S for the freshmen and upperclassmen samples.

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	Mean	SD	Skew	Kurtosis
1	-	0.42	0.17	0.09	0.33	0.36	0.16	0.38	0.33	0.28	0.09	0.28	0.32	0.30	0.14	0.11	0.34	0.19	0.22	0.30	0.36	5.73	1.27	-0.89	0.23
2	0.30	-	0.14	0.13	0.33	0.52	0.34	0.31	0.57	0.33	0.03	0.48	0.37	0.49	0.15	0.32	0.41	0.36	0.26	0.23	0.51	5.93	1.12	-1.22	1.74
3	0.09	0.08	-	0.29	0.19	0.19	0.25	0.25	0.19	0.17	0.16	0.18	0.31	0.23	0.33	0.20	0.27	0.30	0.55	0.29	0.24	5.15	1.46	-0.71	-0.01
4	0.16	0.10	0.23	-	0.00	0.05	0.13	0.07	0.02	0.04	0.20	0.04	0.16	0.09	0.21	0.15	0.18	0.12	0.29	0.20	0.10	3.48	1.51	0.22	-0.49
5	0.16	0.27	0.12	-0.02	-	0.44	0.19	0.40	0.33	0.37	-0.02	0.38	0.43	0.42	0.16	0.16	0.34	0.24	0.27	0.22	0.40	5.41	1.16	-0.43	-0.27
6	0.21	0.49	0.07	0.07	0.39	-	0.32	0.40	0.50	0.33	0.05	0.45	0.34	0.47	0.13	0.26	0.44	0.37	0.26	0.20	0.58	5.91	0.98	-0.86	0.52
7	0.16	0.32	0.17	0.13	0.07	0.31	-	0.28	0.36	0.20	0.08	0.33	0.23	0.32	0.22	0.55	0.34	0.43	0.34	0.25	0.39	5.59	1.57	-1.08	0.39
8	0.27	0.26	0.19	0.08	0.27	0.27	0.27	-	0.33	0.37	0.02	0.31	0.33	0.35	0.17	0.18	0.49	0.22	0.25	0.22	0.39	5.41	1.28	-0.62	-0.13
9	0.25	0.47	0.10	0.04	0.25	0.39	0.28	0.29	-	0.35	0.01	0.52	0.30	0.49	0.19	0.35	0.42	0.44	0.28	0.26	0.53	6.07	1.03	-1.12	1.02
10	0.20	0.30	0.10	0.05	0.28	0.26	0.14	0.32	0.32	-	-0.10	0.36	0.47	0.37	0.14	0.22	0.32	0.19	0.24	0.20	0.36	5.33	1.29	-0.52	-0.17
11	0.09	-0.06	0.10	0.21	-0.10	-0.09	0.06	-0.01	-0.08	-0.09	-	0.02	-0.03	-0.01	0.16	0.04	0.06	0.12	0.15	0.24	0.02	3.93	1.48	0.01	-0.51
12	0.22	0.33	0.09	0.07	0.30	0.36	0.25	0.18	0.37	0.16	-0.07	-	0.42	0.58	0.23	0.40	0.40	0.47	0.32	0.28	0.55	6.25	0.99	-1.31	1.04
13	0.25	0.36	0.16	0.13	0.36	0.37	0.20	0.28	0.31	0.36	-0.11	0.41	-	0.54	0.28	0.29	0.40	0.25	0.39	0.31	0.42	5.09	1.35	-0.49	-0.20
14	0.25	0.41	0.11	0.10	0.31	0.39	0.25	0.26	0.45	0.28	-0.10	0.46	0.48	-	0.27	0.38	0.41	0.37	0.35	0.26	0.54	5.55	1.18	-0.65	0.05
15	0.08	0.16	0.28	0.22	0.16	0.14	0.24	0.18	0.14	0.11	0.06	0.19	0.25	0.24	-	0.28	0.19	0.30	0.35	0.33	0.22	4.73	1.56	-0.48	-0.49
16	0.09	0.31	0.13	0.14	0.11	0.25	0.42	0.14	0.29	0.15	0.01	0.30	0.22	0.29	0.29	-	0.25	0.41	0.34	0.26	0.34	5.18	1.77	-0.80	-0.43
17	0.27	0.37	0.19	0.16	0.23	0.34	0.32	0.42	0.33	0.25	0.01	0.27	0.32	0.35	0.20	0.227	-	0.32	0.31	0.25	0.52	5.57	1.32	-1.02	0.90
18	0.14	0.36	0.18	0.13	0.18	0.34	0.36	0.20	0.35	0.14	0.01	0.37	0.26	0.35	0.29	0.35	0.28	-	0.46	0.36	0.45	6.11	1.11	-1.69	3.57
19	0.20	0.25	0.44	0.26	0.22	0.21	0.26	0.26	0.22	0.20	0.07	0.24	0.33	0.28	0.35	0.24	0.29	0.40	-	0.43	0.37	5.47	1.46	-0.96	0.35
20	0.30	0.19	0.21	0.25	0.09	0.18	0.20	0.15	0.19	0.12	0.20	0.24	0.21	0.21	0.29	0.20	0.19	0.31	0.35	-	0.29	5.43	1.46	-0.94	0.33
21	0.22	0.41	0.11	0.10	0.30	0.47	0.30	0.26	0.37	0.26	-0.09	0.38	0.35	0.41	0.17	0.25	0.38	0.35	0.27	0.22	-	5.96	0.95	-0.94	0.83
Mean	5.91	5.84	4.94	4.15	5.45	5.91	5.89	5.14	5.87	4.88	3.59	6.48	5.33	5.52	4.85	5.33	5.54	6.09	5.58	5.71	6.06				
SD	1.17	1.07	1.34	1.56	1.19	1.00	1.32	1.32	1.14	1.33	1.47	0.88	1.17	1.15	1.46	1.73	1.3	1.08	1.33	1.36	0.93				
Skew	-1.09	-0.90	-0.48	-0.08	-0.65	-0.98	-1.42	-0.42	-1.21	-0.31	0.22	-2.09	-0.53	-0.77	-0.55	-0.91	-1.00	-1.68	-1.12	-1.36	-1.42				
Kurtosis	1.02	0.76	-0.20	-0.63	0.14	1.16	1.76	-0.41	1.62	-0.24	-0.48	4.93	0.10	0.57	-0.31	-0.22	0.84	3.64	1.01	1.65	3.53				

Note: Bottom half of the correlation table and descriptive statistics is the Freshmen sample (N = 2598). Top half of the correlation table and descriptive statistics is the Upperclassmen sample (N = 1035).

Table 2
Correlations and descriptive statistics for the BNSG-S for the Psychology Sample.

Item	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21		
1	1.00																						
2	0.13	1.00																					
3	0.06	0.09	1.00																				
4	0.18	0.17	0.35	1.00																			
5	0.06	0.14	0.24	0.10	1.00																		
6	0.12	0.44	0.09	0.10	0.19	1.00																	
7	0.17	0.35	0.18	0.23	0.10	0.28	1.00																
8	0.23	0.22	0.17	0.20	0.14	0.21	0.32	1.00															
9	0.13	0.50	0.04	0.06	0.09	0.31	0.28	0.19	1.00														
10	0.13	0.20	0.11	0.14	0.27	0.16	0.14	0.18	0.13	1.00													
11	0.11	0.02	0.09	0.15	0.00	-0.02	0.10	0.11	-0.01	-0.08	1.00												
12	0.09	0.40	0.11	0.22	0.20	0.32	0.27	0.18	0.34	0.23	-0.01	1.00											
13	0.23	0.29	0.29	0.28	0.29	0.18	0.23	0.29	0.24	0.45	-0.01	0.34	1.00										
14	0.16	0.52	0.15	0.18	0.19	0.37	0.33	0.28	0.44	0.32	-0.02	0.48	0.46	1.00									
15	0.22	0.26	0.37	0.32	0.25	0.13	0.38	0.22	0.16	0.23	0.16	0.27	0.38	0.34	1.00								
16	0.13	0.39	0.08	0.15	0.14	0.25	0.51	0.19	0.31	0.18	0.00	0.41	0.30	0.41	0.35	1.00							
17	0.26	0.37	0.26	0.27	0.10	0.30	0.34	0.44	0.34	0.19	0.03	0.36	0.32	0.45	0.31	0.28	1.00						
18	0.14	0.42	0.18	0.13	0.18	0.32	0.42	0.20	0.41	0.13	0.08	0.46	0.27	0.46	0.34	0.44	0.35	1.00					
19	0.15	0.20	0.60	0.40	0.29	0.16	0.23	0.21	0.12	0.14	0.10	0.23	0.38	0.23	0.43	0.19	0.27	0.31	1.00				
20	0.36	0.16	0.22	0.27	0.10	0.17	0.15	0.18	0.10	0.11	0.17	0.17	0.30	0.23	0.32	0.17	0.26	0.22	0.30	1.00			
21	0.17	0.36	0.12	0.12	0.19	0.47	0.38	0.24	0.37	0.19	0.05	0.41	0.26	0.47	0.24	0.34	0.41	0.47	0.14	0.22	1.00		
Mean	6.00	5.82	5.28	3.46	5.52	6.07	5.90	5.58	6.23	5.35	3.97	6.38	5.18	5.45	5.03	5.30	5.71	6.29	5.62	5.72	6.04		
SD	0.96	1.05	1.33	1.51	1.01	0.82	1.29	1.05	0.94	1.31	1.42	0.83	1.18	1.13	1.42	1.77	1.25	0.88	1.40	1.35	0.83		
Skew	-0.77	-0.82	-0.93	0.17	-0.54	-1.08	-1.42	-0.46	-1.43	-0.68	-0.02	-1.51	-0.60	-0.67	-0.67	-0.89	-1.28	-1.76	-1.27	-1.43	-1.05		
Kurtosis	-0.04	0.50	0.51	-0.56	-0.13	2.19	1.78	-0.28	2.19	0.06	-0.59	2.79	0.52	0.32	-0.16	-0.29	1.78	4.90	1.34	1.91	2.11		

Note: N = 492.

Table 3
Fit indices for the hypothesized models.

Model	χ^2_{SB}	df	SRMR	RMSEA _{SB}	CFI _{SB}
(1) 21-item, one-factor					
Freshmen sample	3620.58*	189	0.068	0.08	0.88
Upperclassmen sample	2063.13*	189	0.075	0.10	0.89
(2) 21-item, three-factor					
Freshmen sample	3364.81*	186	0.064	0.08	0.89
Upperclassmen sample	–	–	–	–	–

Note: χ^2_{SB} = Satorra–Bentler (SB) adjusted chi-square; SRMR = standardized root mean square residual; RMSEA_{SB} = the SB scaled root mean square error of approximation; CFI = the SB scaled comparative fit index. $N_{Freshmen}$ = 2598.

$N_{Upperclassmen}$ = 1035.

* $p < .05$.

biased estimates of model fit and more accurate standard errors of the estimated parameters (Finney & DiStefano, 2006).⁴

Model fit was examined using several different global fit indices including the χ^2_{SB} , the standardized root mean square residual (SRMR), the SB scaled root mean square error of approximation (RMSEA_{SB}), and the SB scaled comparative fit index (CFI_{SB}). It should be noted that the SB scaling method does not adjust the SRMR. The SRMR, RMSEA_{SB}, and the CFI_{SB} were chosen based on evidence that they are not as sensitive to sample size as the χ^2_{SB} , they are sensitive to misspecified factor correlations and misspecified factor loadings, and they function well in conjunction with ML (Brown, 2006; Hu & Bentler, 1998, 1999).

Researchers have recommended the following cutoff values as indicative of model fit when the distribution of the data being modeled is non-normal: .07 or less for the SRMR, .05 or below for the RMSEA_{SB}, and .95 or higher for the CFI_{SB} (Yu & Muthén, 2002). However, given that the recommendations for cutoffs are based on only one study, researchers have recommended that the suggested cutoff criteria be used as *guidelines* rather than strict criteria to assess model-data fit (Marsh, Hau, & Wen, 2004). Specifically, until further research is performed regarding the performance of the fit indices, researchers have recommended using the newer criteria as an upper bound and the older criteria as a lower bound for evaluating model fit (Marsh et al., 2004; Vandenberg & Lance, 2000). The values used as the lower bounds of adequate model fit are as follows: SRMR values of .08 or less (Hu & Bentler, 1999), RMSEA values of .08 or less (Browne & Cudeck, 1993), and CFI values of .90 or greater (Bentler, 1990). In addition to examining areas of global fit, areas of local misfit, as indicated by standardized covariance residuals greater than the absolute value of 4, were also taken into account when assessing model fit (Brown, 2006; Byrne, 1998; Marsh et al., 2004). Positive standardized covariance residual values are indicative that a relationship between two observed variables was underestimated by the model, whereas negative standardized covariance residuals are indicative of a relationship being overestimated by the model.

3.1.1. CFA: freshmen and upperclassmen samples

Results of the CFAs associated with the hypothesized models in the freshmen and upperclassmen samples are presented in Table 3. The analyses revealed two important things. First, as expected, the one-factor model (Model 1) did not fit the data in either the freshmen or upperclassmen samples, thus supporting the hypothesis that the BNSG-S is multidimensional. Second, contrary to expectations, the theoretically-based three-factor model (Model 2) did not fit the data in the freshmen sample and failed to converge to a

solution in the upperclassmen sample. Interestingly, a majority of the local misfit in Model 2 was associated with negatively-worded items and autonomy items.

3.1.1.1. Diagnosing model misfit and model modification. Because Model 2 did not fit the data in the freshmen sample and failed to converge to a solution in the upperclassmen sample, the focus of the data analyses shifted to diagnosing areas of misfit. Specifically, a series of models based on theoretical, empirical, and item-wording considerations were tested. It is important to note that all modifications made to the three-factor model or the BNSG-S were tested in succession. Given the areas of local misfit may simply be a reflection of the idiosyncratic characteristics of a particular data set, it was important to make sure that areas of local misfit were consistent across all three samples (MacCallum, Roznowski, & Necowitz, 1992). Thus, the areas of misfit were first diagnosed within and across the freshmen and upperclassmen samples, and were then cross-validated using the psychology sample.

The fit indices for the modified models tested within the freshmen and upperclassmen samples are presented in Table 4. Because a substantial amount of local misfit displayed within Model 2 was associated with negatively-worded items, the first modified model was a three-factor model (Model 3) with a negative-worded method effect (see Table 4). A negative-worded method effect indicates that negatively-worded items share common variance that is not explained, nor is related to the respective substantive latent factors (i.e., the need factors), but is instead related to the fact that the items are negatively worded (Kline, 2005; Marsh, 1996). Although the fit indices revealed Model 3 had adequate global fit across both samples, there was a substantial amount of local misfit as indicated by several large standardized covariance residuals.

To help further diagnose model-data misfit, three one-factor models representing the three needs (autonomy, competence, and relatedness) were tested, thereby allowing specific areas of misfit *within* each subscale to be revealed (see Bollen, 2000 for an overview of this method). Given that the majority of the local misfit within both samples appeared to be associated with items from the need for autonomy subscale, the one-factor models of the need for competence and relatedness were tested first (Models 4 and 6), a two-factor model containing the needs for competence and relatedness was tested next (Model 8), followed by the one-factor model of autonomy (Model 10). Any modifications to the scale or model were based on theoretical *and* empirical considerations. After the misfit associated with each individual needs model was diagnosed, the modified models were rejoined to create a modified three-factor model (Model 15). The results of the process are presented below.

The process of assessing and diagnosing consistent areas of local misfit across both the freshmen and upperclassmen samples revealed five major patterns. First, none of the three one-factor models fit the data, which was expected given the negative method effect was not modeled (Models 4, 6, and 10). Second, when the negative method effect was modeled for the need for competence and need for relatedness items, model misfit was minimal; thus, the local misfit displayed in Models 4 and 6 was mainly the result of negative wording (see Models 5 and 7). Third, when modeling the relatedness and competence items together (two-factor model with negative method effect), items 7 and 16 on the need for relatedness subscale had a large standardized covariance residual across both freshmen (7.64) and upperclassmen (8.20) samples (Model 8). Examination of the wording of items 7 and 16 (“I pretty much keep to myself and don’t have a lot of social contacts”, “There are not many people I am close to”) revealed the items to be redundant. Because only one item is needed, and item 7 appeared to be more representative of the need for relatedness, item 16 was removed (Model 9). Examination of global and local areas

⁴ At the suggestion of a reviewer, we also estimated the models using the WLSMV estimator for ordered categorical data available in Mplus (Muthén & Muthén, 1998) and this resulted in no substantive changes in conclusions.

Table 4
Fit indices for the modified models for the freshmen and upperclassmen samples.

Model		χ^2_{SB}	df	SRMR	RMSEA _{SB}	CFI _{SB}
(3)	21-item, three-factor with method effect					
	Freshmen sample	1571.81*	177	0.045	0.06	0.95
	Upperclassmen sample	853.01*	177	0.046	0.06	0.96
<i>Competence models</i>						
(4)	6-item, one-factor					
	Freshmen sample	423.99*	9	0.073	0.13	0.82
	Upperclassmen sample	245.36*	9	0.079	0.16	0.82
(5)	6-item, one-factor with method effect					
	Freshmen sample	14.73*	6	0.014	0.02	1.00
	Upperclassmen sample	12.08	6	0.019	0.03	1.00
<i>Relatedness models</i>						
(6)	8-item, one-factor					
	Freshmen sample	274.25*	20	0.044	0.07	0.95
	Upperclassmen sample	228.99*	20	0.061	0.10	0.94
(7)	8-item, one-factor with method effect					
	Freshmen sample	102.77*	17	0.024	0.04	0.98
	Upperclassmen sample	69.35*	17	0.028	0.05	0.99
<i>Competence and relatedness models</i>						
(8)	14-item, two-factor with method effect					
	Freshmen sample	618.06*	70	0.041	0.05	0.96
	Upperclassmen sample	356.04*	70	0.044	0.06	0.97
(9)	13-item, two-factor with method effect ^a					
	Freshmen sample	432.79*	59	0.035	0.05	0.97
	Upperclassmen sample	205.75*	59	0.036	0.05	0.98
<i>Autonomy models</i>						
(10)	7-item, one-factor					
	Freshmen sample	444.96*	14	0.071	0.11	0.81
	Upperclassmen sample	137.05*	14	0.063	0.09	0.89
(11)	7-item, one-factor with method effect					
	Freshmen sample	161.38*	11	0.043	0.07	0.93
	Upperclassmen sample	43.90*	11	0.03	0.05	0.97
(12)	6-item, one-factor with method effect ^b					
	Freshmen sample	113.67*	6	0.043	0.08	0.93
	Upperclassmen sample	33.03*	6	0.031	0.07	0.97
(13)	5-item, one-factor ^c					
	Freshmen sample	105.73*	4	0.046	0.10	0.92
	Upperclassmen sample	29.93*	4	0.034	0.08	0.96
(14)	4-item, one-factor ^d					
	Freshmen sample	28.15*	2	0.028	0.07	0.97
	Upperclassmen sample	13.33*	2	0.026	0.07	0.98
<i>Rejoined modified models</i>						
(15)	16-item, three-factor model with method effect ^e					
	Freshmen sample	670.23*	96	0.037	0.05	0.97
	Upperclassmen sample	338.01*	96	0.037	0.05	0.98

^a Item 16 was removed.

^b Item 14 was removed.

^c Items 14 and 11 were removed.

^d Items 14, 11, and 20 were removed.

^e Items 16, 14, 11, 20, and 4 were removed.

* $p < .05$.

of fit revealed a two-factor model with a negative method effect factor (Model 9) fit the 13 relatedness and competence items adequately across both samples.

Fourth, the substantial amount of local misfit displayed in Model 11 indicated the negative method effect did not explain all of the misfit associated with the autonomy items. As a result, a series of models (Models 12–14) were estimated in order to better understand the interrelationships among the need for autonomy items. Theoretical and empirical issues with items 14, 1, 20, 4, and 11 were revealed. In regards to the theoretical issues, examination of the wording of item 14 (“People I interact with on a daily basis tend to take my feelings into consideration”) revealed the item was more representative of the need for relatedness than the need for autonomy. In addition, items 1 and 20 appeared to be reciprocals of one

another (i.e., one was positively worded and one was negatively worded); they were opposite and essentially redundant with one another. Finally, item 4 appeared to be written too generally to be applicable only to the need for autonomy (“I feel pressured in my life”). That is, people may feel pressured in their life due to a failure to fulfill the need for competence or relatedness or autonomy. Importantly, all these items also had very low R^2 values, indicating the items had little or no utility. Thus, the modifications to Models 12–14 were based on all of these considerations: Model 12 reflects the removal of item 14; Model 13 reflects the removal of item 11; and Model 14 reflects the removal of item 20. Model 15, which reflects the removal of item 4, also reflects the joining of Models 9 and 14 with a negative method effect, thus creating a 16-item, three-factor model with a negative method effect (see Fig. 2).

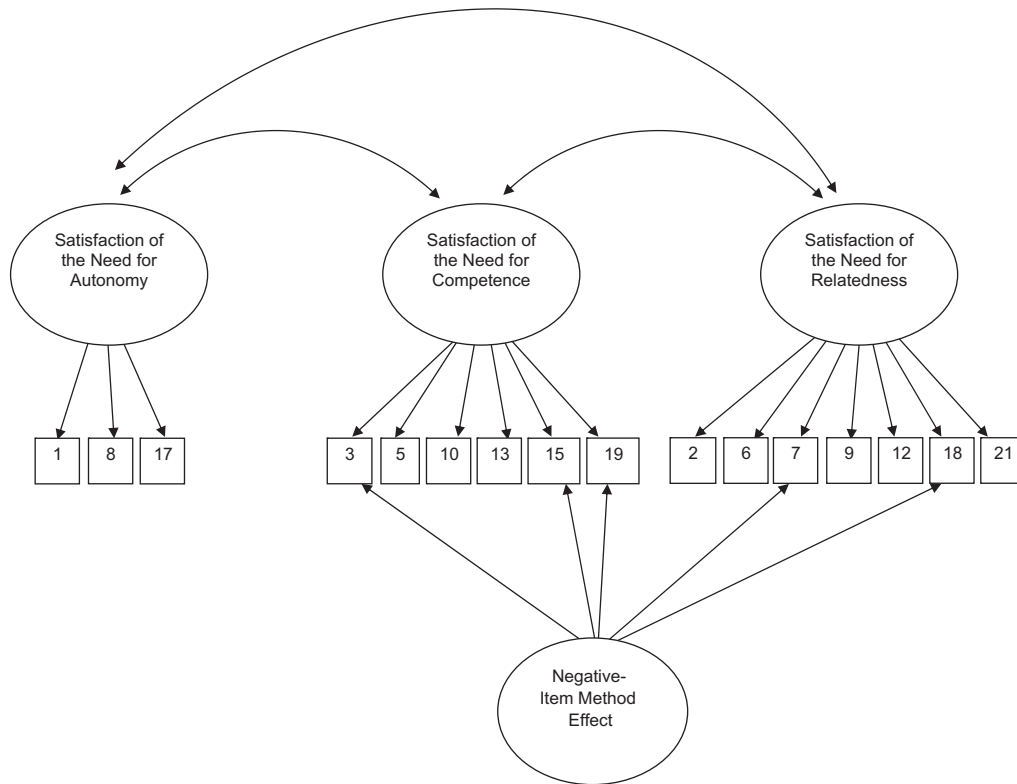


Fig. 2. Sixteen-item, three-factor model of the BNSG-S with a negative method effect.

Fifth, Model 15 adequately fit the data in a global sense; however, it is important to note there were two consistent areas of local misfit across both samples (as indicated by large standardized covariance residuals) between items 5 and 6 (6.3, 4.59), and between items 3 and 18 (−8.15, −4.09). Although these two areas of local misfit were common across both samples, there was no theoretical or practical reason why the items should be removed or the model should be modified further. Thus, Model 15 was championed in the freshmen and upperclassmen samples.

3.1.2. CFA: psychology sample

It is important to note that although the modifications to the original 21-item three-factor model (Model 2) were based on empirical, conceptual, practical, and theoretical considerations, the modifications were still influenced by the idiosyncratic characteristics that were shared by the freshmen and upperclassmen samples. That is, data were collected in a large scale low-stakes testing context. Thus, students may not have been motivated to put forth effort on the series of tests. Therefore, it was important to examine the models using another sample of students tested in smaller more controlled settings to see if patterns of misfit replicated.

The patterns of misfit were relatively consistent across all three samples. That is, within the psychology sample, the theoretical models did not fit the data, the need for relatedness item 16 displayed a large standardized residual with item 7 (4.35), the need for autonomy items 4, 11, and 20 were found to be poorly performing items, and a negative method effect was present. Examination of the global fit indices for Model 15 revealed adequate model-data fit (see Table 5). Examination of the standardized covariance residuals of Model 15 revealed one large standardized covariance residual between items 7 and 15 (4.54). However, given this area of local misfit was not found in the freshmen or upperclassmen data, and given there was no theoretical reason for this misfit, Model 15

was championed. In sum, model fit and misfit was extremely consistent across all three samples, and the 16-item three-factor model with a negative method effect reproduced the relationships among the variables well.

3.1.3. Parameter estimates for Model 15

Examination of the parameter estimates for Model 15 across all three samples revealed three important points (see Table 6).⁵ First, all of the unstandardized pattern coefficients were statistically significant. Second, the majority of items across all three samples had less than 50% of their variance accounted for by the respective substantive factors. Only two items (13 and 17) had at least 50% of their variance accounted for by their respective substantive factors across both the upperclassmen and psychology samples; none of the items within the freshmen sample had at least 50% of their variance accounted for by their respective substantive factors. Thus, a majority of the items across all three samples had large amounts of unexplained variance (i.e., error variance), which is not desirable. In particular, only 6%, 16%, and 14% of the variance in item 3 was explained by the need for competence, and only 20%, 30%, and 13% of the variance in item 1 was explained by the need for autonomy in the freshmen, upperclassmen, and psychology samples, respectively. These low values across the three samples indicate items 3 and 1 do not have much utility. Third, quality negative items should reflect their substantive factor more than the negative method effect. Unfortunately, across all three samples, only two (i.e., items 7 and 18) of the five negative items had higher standardized pattern coefficients with their substantive factor (i.e., the need for relatedness) than the negative method effect factor.

⁵ Only the standardized pattern coefficients associated with the modified 16-item three-factor model with a negative method effect for all three samples have been presented to save space. Other parameter estimates are available by request from the first author.

Correlations between the factors, subscale reliabilities, and the amount of variance explained by each factor are reported for all three samples in Table 7. The factor correlations were positive. Interestingly, the factor correlations in the psychology sample were substantially lower (i.e., factors more distinct) than in the freshmen or upperclassmen samples.

The reliability for the need for relatedness subscale was acceptable (above .78) across all three samples, whereas the reliabilities for the need for autonomy and the need for relatedness subscales were low (see Table 7).⁶ Variance extracted represents the total amount of variance within the items accounted for by their substantive factors. The variance extracted for the three needs across all three samples was below .46, thus indicating the factors accounted for less than 46% of the items' variance. Given this information, it appears that the subscale scores are not explained very well by their respective factors.

3.2. Phase two of analysis: external validity evidence

If the three factors of the need for autonomy, competence, and relatedness are truly distinct constructs, then differential relationships between the three factors and theoretically related external variables should emerge. To address the second purpose of the study, a series of CFA models estimated the relationships between the three needs factors and each external construct. Specifically, one general model was specified and was simply adjusted for each individual external construct (see Fig. 3). That is, the championed 16-item, three-factor model with a negative method effect was modeled with a single-indicator factor representing the external variable. Modeling the three needs factors with the negative effect allowed for the removal of shared variance due to negative item wording, thus providing more accurate relationships with external variables than would be afforded by computing three observed subscale scores representing the satisfaction of needs (Conway, 2004). Given there were seven external variables, a total of seven models were estimated. Modeling the external variables as factors, as opposed to observed scores, allowed the error variance in the

Table 5

Fit indices for the psychology sample.

Model	χ^2_{SB}	df	SRMR	RMSEA _{SB}	CFI _{SB}
(1) 21-item, one-factor	981.91*	189	0.081	0.09	0.85
(2) 21-item, three-factor	685.67*	186	0.068	0.07	0.91
(3) 21-item, three-factor with method effect	438.92*	177	0.054	0.05	0.95
<i>Competence models</i>					
(4) 6-item, one-factor	91.44*	9	0.083	0.14	0.86
(5) 6-item, one-factor with method effect	20.54*	6	0.045	0.07	0.98
<i>Relatedness models</i>					
(6) 8-item, one-factor	87.15*	20	0.052	0.08	0.93
(7) 8-item, one-factor with method effect	55.94*	17	0.039	0.07	0.96
<i>Competence and relatedness model</i>					
(8) 14-item, two-factor with method effect	189.38*	70	0.051	0.06	0.95
(9) 13-item, two-factor with method effect ^a	134.44*	59	0.047	0.05	0.96
<i>Autonomy models</i>					
(10) 7-item, one-factor	68.51*	14	0.059	0.09	0.89
(11) 7-item, one-factor with method effect	41.10*	11	0.049	0.07	0.94
(12) 6-item, one-factor with method effect ^b	31.37*	6	0.047	0.09	0.93
(13) 5-item, one-factor ^c	25.55*	4	0.051	0.10	0.93
(14) 4-item, one-factor ^d	1.68	2	0.016	0.00	1.00
<i>Rejoined modified model</i>					
(15) 16-item, three-factor with method effect ^e	190.74*	96	0.047	0.04	0.97

Note: χ^2_{SB} = Satorra–Bentler (SB) adjusted chi-square; SRMR = standardized root mean square residual; RMSEA_{SB} = the SB scaled root mean square error of approximation; CFI = the SB scaled comparative fit index. $N = 492$.

^a Item 16 was removed.

^b Item 14 was removed.

^c Items 14 and 11 were removed.

^d Items 14, 11, and 20 were removed.

^e Items 16, 14, 11, 20, and 4 were removed.

* $p < .05$.

observed scores to be removed (Maruyama, 1998).⁷ Thus, the factor correlations between the three needs factors and the external factors were estimated at the latent level without measurement error (Brown, 2006).

3.2.1. Investigating differential relationships between factors

In order to investigate whether the three needs factors were differentially related to an external factor, three models were estimated by constraining a pair of factor correlations between two needs factors and the external factor to be equal. The constrained models were nested within the unconstrained external model (Fig. 3). A chi-square difference test ($\Delta\chi^2$) assessed whether the fit of the constrained model was significantly worse than the fit

⁶ Given two of the three factors had items that were modeled to be multidimensional, two different equations were used to calculate reliability. First, in order to calculate the reliability for the need for autonomy factor, in which all items were modeled to be unidimensional, the following equation was used:

$$\frac{(\sum b_i)^2}{(\sum b_i)^2 + \sum e_i} \quad (1)$$

where b_i is the unstandardized pattern coefficient and e_i is the unstandardized error variance of the items representing the factor of the need for autonomy (McDonald, 1999).

Interestingly, there does not appear to be a general consensus regarding the appropriate way to calculate the reliability of items when a method effect is modeled (e.g., Bentler, 2009; Sijtsma, 2009a; Sijtsma, 2009b). Researchers have used Eq. (2), or a variation of Eq. (2) (see Green & Yang, 2009; McDonald, 1999, Eq. (6.20)), to calculate the reliability:

$$\frac{(\sum b_i)^2}{(\sum b_i)^2 + \sum e_i + (\sum b_j)^2} \quad (2)$$

where b_i is the unstandardized pattern coefficient representing the relationship between the items and the substantive factor, e_i is the unstandardized error variance of the items, and b_j is the unstandardized pattern coefficient representing the relationship between the negatively-worded items on that particular subscale and the negative method effect factor. Specifically, Eq. (2) includes the systematic variance associated with the method effect in the denominator, thus acknowledging that it is part of the total variance associated with the set of items (Conway, 2004; Lucke, 2005). Only the variance associated with the substantive factor is included in the numerator. For the current study, Eq. (2), not Eq. (1), was used to calculate the reliability of the scores for the need for competence and the need for relatedness.

⁷ In order to model an external variable as a single-indicator factor, a series of three steps was completed for each external measure. First, the items on the external measures were summed, thus creating a composite variable for each external variable. It is important to note that there was sufficient evidence from previous studies (see Section 2) to indicate each external measure's scores were unidimensional and the creation of a composite score was appropriate. Second, in order to model the external variables as latent factors, which are free of measurement error, the proportion of the composite variable's variance due to measurement error was calculated ($1 - \text{reliability estimate}$). This value was then multiplied by the external variable's total variance and the resulting value was fixed as the unstandardized error variance of the indicator, thereby leaving only the reliable composite variance to be correlated with the three needs factors. Third, in order to completely standardize the external factor and thus estimate factor correlations instead of factor covariances, the factor variance was fixed to one and the path from the factor to the composite variable was freely estimated. For further information see Kline, 2005 regarding the specification of a single-indicator factor.

Table 6
Standardized pattern coefficients for the championed model for the freshmen, upperclassmen, and psychology samples.

Items by modified subscale	Freshmen sample		Upperclassmen sample		Psychology sample	
	SF	NMF	SF	NMF	SF	NMF
<i>Autonomy items</i>						
(1) I feel like I am free to decide for myself how to live my life.	0.45	–	0.55	–	0.36	–
(8) I generally feel free to express my ideas and opinions.	0.59	–	0.65	–	0.56	–
(17) I feel like I can pretty much be myself in my daily situations.	0.68	–	0.72	–	0.78	–
<i>Competence items</i>						
(3) Often, I do not feel very competent. (R)	0.25	0.50	0.40	0.54	0.37	0.61
(5) People I know tell me I am good at what I do.	0.54	–	0.63	–	0.42	–
(10) I have been able to learn interesting new skills recently.	0.52	–	0.61	–	0.53	–
(13) Most days I feel a sense of accomplishment from what I do.	0.68	–	0.71	–	0.77	–
(15) In my life I do not get much of a chance to show how capable I am. (R)	0.33	0.38	0.33	0.34	0.52	0.30
(19) I often do not feel very capable. (R)	0.48	0.60	0.52	0.63	0.48	0.67
<i>Relatedness items</i>						
(2) I really like the people I interact with.	0.68	–	0.71	–	0.67	–
(6) I get along with people I come into contact with.	0.68	–	0.71	–	0.57	–
(7) I pretty much keep to myself and don't have a lot of social contacts. (R)	0.46	0.23	0.49	0.27	0.54	0.15
(9) I consider the people I regularly interact with to be my friends.	0.63	–	0.72	–	0.60	–
(12) People in my life care about me.	0.56	–	0.70	–	0.61	–
(18) The people I interact with regularly do not seem to like me much. (R)	0.54	0.33	0.57	0.39	0.67	0.18
(21) People are generally pretty friendly towards me.	0.65	–	0.78	–	0.67	–

Note: All unstandardized parameter estimates were statistically significant. The reported standardized coefficients can be squared to reflect the amount of variance in the item explained by the factor. (R) = indicates items that were reversed scored. SF = substantive factor. NMF = negative method factor.

$N_{\text{Freshmen}} = 2598$. $N_{\text{Upperclassmen}} = 1035$. $N_{\text{Psychology}} = 492$.

Table 7
Subscale correlations, reliabilities, and variance explained for the freshmen, upperclassmen, and psychology samples.

	Freshmen sample			Upperclassmen sample			Psychology sample		
	A	C	R	A	C	R	A	C	R
Autonomy	1.00			1.00			1.00		
Competence	0.77	1.00		0.82	1.00		0.60	1.00	
Relatedness	0.76	0.78	1.00	0.81	0.75	1.00	0.70	0.57	1.00
Reliability	0.60	0.55	0.78	0.68	0.62	0.82	0.62	0.60	0.80
Variance extracted	0.34	0.24	0.37	0.42	0.30	0.45	0.35	0.28	0.47

Note: A = autonomy; C = competence; R = relatedness. The unstandardized path coefficients and error terms were used to calculate reliability.

$N_{\text{Freshmen}} = 2598$. $N_{\text{Upperclassmen}} = 1035$. $N_{\text{Psychology}} = 492$.

of the unconstrained model, which in turn tests if the factor correlations were significantly different from each other. Recall that given the assumption of multivariate normality was violated, the χ^2_{SB} was estimated (Satorra & Bentler, 2001). It is important to note that the $\Delta\chi^2_{\text{SB}}$ can produce implausible, negative chi-square values (Satorra & Bentler, 2001, 2009). According to Satorra and Bentler (2009), if an implausible value (e.g., negative chi-square) is produced by the $\Delta\chi^2_{\text{SB}}$ test, it is a sign that at least one of the models being compared is misspecified or the sample size is too small. If this occurs, Satorra and Bentler (2009) offer a new method of computing $\Delta\chi^2_{\text{SB}}$ which ensures the scaled chi-square difference statistic will be positive. This new method was used in the current study.⁸

Results of the $\Delta\chi^2_{\text{SB}}$ tests as well as the factor correlations are presented in Table 8.⁹ The results revealed three important points. First, all of the factor correlations were statistically significantly

different from zero with the exception of the factor correlations between GAS and the need for relatedness and between the MAF and the need for relatedness. In addition, with the exception of the two non-significant factor correlations, the three needs were positively related with the factors of well-being, and were negatively related to the factors of anxiety and motive to avoid failure, as expected.

Second, as predicted, when related to measures of well-being, the three needs factors were distinct and were related to well-being in theoretically expected ways. For instance, as predicted, the AU factor exhibited a significantly stronger positive correlation with the need for competence factor than with the other needs factors, and the PR factor exhibited a significantly stronger positive relationship with the need for relatedness factor than with the other needs factors. Third, contrary to predictions, WST, GAS, and MAF were able to discriminate the need for relatedness factor from the need for autonomy and competence factors, but were *not* able to discriminate the need for autonomy and the need for competence from one another. In addition, SAC was not related to the needs factors as hypothesized; it was more highly correlated with autonomy than with relatedness. These findings and their implications are discussed in detail below.

4. Discussion

Recall, the current study, which followed Benson's (1998) strong program for construct validity, had two purposes. The first purpose of this study was to investigate the dimensionality of the 21-item BNSG-S (Benson's structural stage) whereas the second purpose of the study was to provide external validity evidence for the championed model of the BNSG-S (Benson's external stage).

4.1. Structural stage: dimensionality

Because the theoretical three-factor model did not adequately fit the data, the focus of the first part of the study shifted to diag-

⁸ Unfortunately, LISREL 8.72 was not able to perform the new 2009 $\Delta\chi^2_{\text{SB}}$ test (G. Mels, personal communication, March 13, 2009; A. Satorra, personal communication, March 13, 2009). Thus, EQS 6.0 was used to estimate the CFAs to perform the 2009 $\Delta\chi^2_{\text{SB}}$ tests.

⁹ Fit indices associated with the nested χ^2 difference tests are available from the first author upon request.

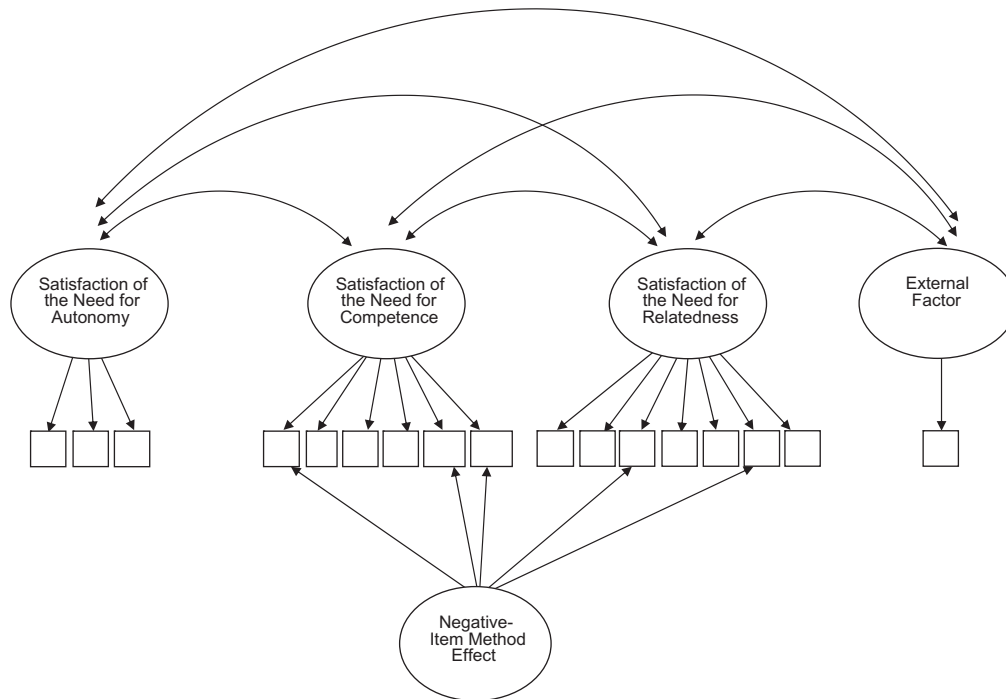


Fig. 3. External validity model: Championed BNSG-S model with an external factor.

Table 8

Factors correlations and differential correlations tests between the three needs factors and external factors in the psychology sample.

	Autonomy	Competence	Relatedness
AU	0.64 ^a	0.41 ^b	0.18 ^c
EM	0.63 ^a	0.82 ^b	0.52 ^c
PR	0.64 ^a	0.63 ^a	0.88 ^b
SAC	-0.60 ^a	-0.36 ^b	-0.26 ^b
WST	-0.37 ^a	-0.40 ^a	-0.20 ^b
GAS	-0.16 ^a	-0.25 ^a	-0.07 ^b
MAF	-0.36 ^a	-0.45 ^a	-0.08 ^b

Note: AU = autonomy. EM = environmental mastery. PR = positive relations with others. SAC = social adequacy concern. WST = worrisome thinking. GAS = generalized anxiety symptoms. MAF = motive to avoid failure.

N = 492.

^a Indicates factor correlations that were statistically significant ($p < .05$). Non-common superscripts indicate factor correlations that are statistically different ($p < .05$).

nosing consistent areas of misfit within the theoretical three-factor model across the three independent samples. Ultimately, a reduced 16-item three-factor model with a negative method effect had the most support across all three samples. As previously mentioned, there were several consistent areas misfit displayed across the three samples including: a substantial amount of local misfit associated with the negatively-worded items, large standardized residuals between items 7 and 16 (both need for relatedness items), the apparent misplacement of item 14 on the need for autonomy subscale, and the low utility of items 4, 11, and 20 (all the need for autonomy items).

The presence of a negative method effect represents trait-irrelevant variance, that when left unaccounted for can have an effect on the reliability of a scale and the validity of inferences made from the measure (Conway, 2004). Thus, it is important for future researchers to account for the presence of common variance due to negative item wording (i.e., model the method factor) using analyses such as confirmatory factor analyses and structural equation

modeling, as opposed to ignoring the method effect's presence.¹⁰

Although the modified model was championed across three independent samples, other psychometric properties (i.e., reliability and variance extracted) were not ideal. Specifically of concern were (a) the low reliabilities (below 0.68) associated with the need for autonomy and need for competence and (b) the large amounts

¹⁰ Researchers may be tempted to create three observed summated composite scores to represent the needs for autonomy, competence, and relatedness and use these composites in analyses (e.g., correlation, regression, ANOVA). We caution against this practice due to the presence of a negative method effect. In addition to these summated scores being contaminated by measurement error, the summated need for competence and need for relatedness scores would be contaminated with construct-irrelevant variance from the negative method effect. Specifically, if the autonomy items, which were unidimensional, were summed and correlated with external variables, the observed correlations would be biased downward due to measurement error. However, the observed correlations between the summated need for relatedness scores and the external variable scores are more difficult to predict. This is because the systematic method variance is included in the summated relatedness scores. Thus, in addition to being biased downward due to measurement error, the observed correlations between the summated relatedness scores and external variable scores could be biased upward or downward depending on the relationship between the negative method effect and the external variable. The same follows for the need for competence.

The method factor exhibited a correlation of .25 with AU, .29 with EM, .14 with PR, -.41 with WST, -.31 with SAC, -.36 with GAD, and -.40 with MAF. The impact of including the method variance in the summated needs scores can be gauged by examining the sign of the correlation between the external variable and the individual need, and examining the sign of the correlation between the external variable and the method effect. For example, EM was correlated .82 with the need for competence and .29 with the method effect. If this method variance isn't partitioned from the need for competence scores, the observed correlation between need for competence and EM would be biased upward (in addition to being biased downward to some extent due to measurement error, as discussed above).

When examining the method effect-external variable correlations above, along with the needs-external variable correlations (only needs for competence and relatedness) in Table 8, one can see that the relationships with summated need for competence scores and summated need for relatedness scores would be biased upward by not modeling the method effect. The utility of modeling the needs construct via SEM is it allows one to not only control for measurement error but to also partition construct-irrelevant variance from substantively relevant variance.

of variance not accounted for by substantive factors. Specifically, a large majority of the variance in the need for competence items was not explained by the need for competence factor, but by the negative method factor. Given the substantive factors did not account for much variance within the items, there may be limited utility of the measure. However, this statement is premature; future studies are needed to further assess the functioning of the modified version of the BNSG-S (i.e., do these results replicate using independent samples and in different populations). In sum, support for the original 21-item three-factor model of the BNSG-S was not found, nor was support for a unidimensional model of needs. Both findings cause concern given the measure has been scored in the past under the assumption that one of these models represented the data (or in some cases the assumption that both scoring methods were appropriate).

4.2. External stage: external validity

External validity evidence for the championed model was collected by examining differential relationships with seven external variables. Interestingly, only three of the seven hypotheses regarding the differential relationships with the needs factors were supported. As expected, the three needs factors on the modified scale exhibited differential and theoretically meaningful relationships with the three factors of psychological well-being (AU, EM, and PR). The pattern of differential correlations provides support for the hypothesis that the factors on the modified scale are distinct and represent the needs for autonomy, competence, and relatedness. It is important to reiterate that the description of the relationships between the needs and well-being are just that, relationships, not causal statements. Other variables may be the true determinants of these relationships (i.e., spurious relationships between needs and well-being).

In contrast, when correlated with the four worry-related factors (i.e., WST, SAC, GAS, and MAF), three of the four hypotheses regarding differential relationships with the three needs were not supported. Interestingly, WST, GAS, and MAF failed to distinguish the need for autonomy factor from the need for competence factor. This could be due to the BNSG-S not representing the needs for autonomy and competence well, inadequate measures of worry, or, it may be that the fulfillment (or lack of fulfillment) of the needs for autonomy and competence have a similar relationship with WST, GAS, and MAF, and vice versa. Although this was not expected, it appears reasonable that changes in the levels of worry-related constructs could be related to a failure to satisfy either the need for autonomy, the need for competence, or both. For instance, if college students feel they are not in control of their actions, (i.e., their need for autonomy is not satisfied), they may be more likely to experience worrisome thoughts, generalized anxiety symptoms, and desire to avoid situations that enhance feelings of worry and anxiety (e.g., Davey, Hampton, Farrell, & Davidson, 1992), or, vice versa – students who consistently or pathologically worry may display less volition over their own thoughts and actions (i.e., they are controlled by worry; Davey et al., 1992). Likewise, if college students do not feel confident in their performance (i.e., their need for competence is not satisfied), they may be more likely to experience troublesome thoughts, physical symptoms due to worry, and the desire to avoid situations that might induce worry. This is in line with previous research regarding worry and anxiety in relation to self-efficacy and competence (Bandura, 1977; Hagtvet & Benson, 1997; Schunk & Pajares, 2005).

The hypothesis that SAC would exhibit a stronger negative relationship with the need for relatedness than with the needs for autonomy or competence was not supported. Interestingly, SAC exhibited a significantly stronger negative relationship with

the need for autonomy than with the needs of relatedness or competence. SAC was hypothesized to be negatively related to the need for relatedness because social adequacy reflects a feeling of worry about relationships with other people. However, examination of the items revealed SAC appeared to be more reflective of a feeling of being *controlled* by worrying about other peoples' opinions, as opposed to being worried about the nature of the relationships with other people. Moreover, a further review of the literature revealed SAC appeared identical to social anxiety, which has been defined as the fear of being in public and interacting with people and the fear of being seen in public (Kashdan, 2004). Thus, the results of the current study may provide evidence to suggest people with SAC or social anxiety may be less likely to enjoy being in public situations because they are controlled by their feelings of worry and anxiety (i.e., the need for autonomy is not satisfied).

4.3. Future research

Although the current research provided the initial study of the measurement of needs satisfaction, much more work is needed. First, researchers should replicate the current study to examine if the areas of misfit replicate across populations and contexts. As noted by MacCallum et al. (1992), modifications based on one sample are influenced by the idiosyncratic characteristics of that specific sample. Although the BNSG-S was not modified unless the misfit was consistent across all three independent samples, the modifications were ultimately based on the idiosyncratic characteristics of the three data sets. Moreover, the functioning of this measure with a non-college population is unknown and needs study. Related to this, the stability of the factor correlations should be examined across different populations and different contexts to assess if the relationships between the three needs changes as a function of population or context.

Second, if the low factor pattern coefficients and hence inadequate reliability replicate in future studies, researchers should consider writing new items. For instance, refining the current items and/or creating new additional items for the need for autonomy subscale may increase the low reliability exhibited. Creation of new items or refinement of existing items could be informed by qualitative studies. Think-aloud procedures, where participants express their cognitions as they process item content, could shed light on the clarity, relevance, and representativeness of items.

Third, and most importantly, unlike the practice employed previously in the BNSG-S literature, the results from this study should *not* be generalized to context-specific measures of needs satisfaction (e.g., BNSW-S). The factor structure and the relationships with external criteria may change given the change in context. For example, given the context-independent nature of the BNSG-S, it may have lower factor pattern coefficients, reliability, and relationships with external criteria than a context-specific measure (e.g., Bing, Whanger, Davison, & VanHook, 2004; Robie, Schmit, Ryan, & Zickar, 2000; Schmit, Ryan, Stierwalt, & Powell, 1995). This issue of specificity of measurement is not new (e.g., Cronbach, 1960; Cronbach & Gleser, 1965; Hogan & Roberts, 1996; Robie et al., 2000; Schmit et al., 1995). In fact, it is often discussed when creating motivation-related measures, such as self-efficacy and goal orientation (e.g., Bong, 2001; Choi, 2005; DeShon & Gillespie, 2005; Elliot, 2005; Finney, Pieper, & Barron, 2004; Finney & Schraw, 2003; Horvath, Scheu, & DeShon, 2004; Pajares, 1996; Pajares & Miller, 1995; Wigfield, 1997). Future research should explore similarities and differences in both dimensionality and nomological net of need satisfaction measures that are operationalized at different levels of specificity.

4.4. Practical implications

Given additional study and refinement of the BNSG-S, the measure could be used for three important reasons. First, given a quality measure of needs satisfaction, aspects of SDT can be empirically tested. For instance, the sub-theories of SDT, OIT and CET, can only be tested with reliable and valid measures of needs satisfaction. That is, we need to recognize that the empirical results from the testing of these theoretical hypotheses are contingent on the measures used to operationalize needs satisfaction. Thus, we need to responsibly examine the domain's existing measures to evaluate their psychometric functioning and, ultimately, their usefulness.

Second, if the satisfaction of the three needs can be reliably assessed, then the measure could be used to identify people whose basic needs are not being adequately satisfied. That is, the measure could have practical use in uncovering people who need intervention or support to overcome their deficits in needs satisfaction.

Third, and following from above, a quality measure of needs satisfaction could be used to evaluate the effectiveness of programs, counseling, or support services targeted towards increasing the fulfillment of needs. Although there are suggestions in the literature regarding different strategies that can be used to increase needs satisfaction, these strategies must be assessed for their effectiveness, which necessitates a quality measure of needs satisfaction. For instance, a commonly recommended strategy to promote needs satisfaction is the adoption and attainment of intrinsic aspirations (i.e., goals such as community involvement, affiliation, and personal growth), as opposed to extrinsic aspirations (i.e., goals such as wealth, fame, and financial success; Kasser & Ryan, 1996; Niemiec et al., 2009). Thus, in order to determine if the adoption and attainment of intrinsic aspirations is effective in increasing needs satisfaction, a quality measure of needs satisfaction is required. Moreover, an adequate measure of needs satisfaction can be used to alter the course of treatment for patients who suffer from symptoms as a result of their needs not being satisfied. For instance, upon demonstrating needs satisfaction mediating role between maladaptive adult attachment orientations and feelings of shame, loneliness, and depression, Wei et al. (2005) recommended clinicians focus on increasing patients' satisfaction of needs rather than focusing solely on treating the maladaptive characteristics of attachment orientations such as self-concealment.

5. Conclusions

In closing, it is important to note that although there are several different conceptualizations of basic needs satisfaction, the current research focused only on needs satisfaction as defined by SDT. Following Benson's (1998) strong program of construct validity, validity evidence for the BNSG-S was gathered for the structural and external stages. In regards to the structural stage, the current study provided (a) empirical evidence of the multidimensional nature of needs and (b) evidence of a negative method effect associated with the BNSG-S. In regards to the external stage, the current study makes a theoretical contribution by providing further evidence that the three needs factors are distinct and are, in general, related to external variables in theoretical and meaningful ways. Although previous studies have used the BNSG-S and have reported relationships between the needs and various constructs, this is the first study that has examined the dimensionality of the measure and used the resulting factor structure to assess relationships with theoretically-related variables. In conclusion, this study brings us one step closer to creating a quality measure of needs satisfaction.

Appendix A

A.1. Feelings I Have

Please read each of the following items carefully, thinking about how it relates to your life, and then indicate how true it is for you. Use the following scale to respond:

	1	2	3	4	5	6	7
	Not at all true			Somewhat true			Very true
1.	I feel like I am free to decide for myself how to live my life.						
2.	I really like the people I interact with.						
3.	Often, I do not feel very competent.						
4.	I feel pressured in my life.						
5.	People I know tell me I am good at what I do.						
6.	I get along with people I come into contact with.						
7.	I pretty much keep to myself and don't have a lot of social contacts.						
8.	I generally feel free to express my ideas and opinions.						
9.	I consider the people I regularly interact with to be my friends.						
10.	I have been able to learn interesting new skills recently.						
11.	In my daily life, I frequently have to do what I am told.						
12.	People in my life care about me.						
13.	Most days I feel a sense of accomplishment from what I do.						
14.	People I interact with on a daily basis tend to take my feelings into consideration.						
15.	In my life I do not get much of a chance to show how capable I am.						
16.	There are not many people that I am close to.						
17.	I feel like I can pretty much be myself in my daily situations.						
18.	The people I interact with regularly do not seem to like me much.						
19.	I often do not feel very capable.						
20.	There is not much opportunity for me to decide for myself how to do things in my daily life.						
21.	People are generally pretty friendly towards me.						

Scoring Guide for the BNSG-S found on measures website^a

Autonomy	1, 4(R), 8, 11(R), 14, 17, 20(R)
Competence	3(R), 5, 10, 13, 15(R), 19(R)
Relatedness	2, 6, 7(R), 9, 12, 16(R), 18(R), 21

Note: (R) indicates items that need to be reversed scored.

^a The BNSG-S can be retrieved from the website, <http://www.psych.rochester.edu/SDT/questionnaires.php>, which is maintained by E. Deci and R. Ryan from the University of Rochester. It should be noted that the website is subject to change.

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