

When does Independent Problem-Solving have Negative Psychological Effects?

Investigating the Moderating Effect of Openness to Experience

by

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Dissertation

Presented to the School of Psychology of

The University of Newcastle, Australia

in Fulfilment

of the Requirements

for the Degree of

Doctor of Philosophy – Science (Psychology)

January 2016

Statement of Originality

The thesis contains no material which has been accepted for the award of any other degree or diploma in any university or other tertiary institution and, to the best of my knowledge and belief, contains no material previously published or written by another person, except where due reference has been made in the text. I give consent to the final version of my thesis being made available worldwide when deposited in the University's Digital Repository, subject to the provisions of the Copyright Act 1968.

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Samineh Sanatkar

Acknowledgements

Knowledge and happiness never decrease by being shared. This thesis would not have been possible without the tireless help of my supervisors. My primary supervisor, Dr Mark Rubin, dedicated countless hours to guide me through my research and to provide essential feedback on my thesis drafts. His motivation, commitment, and wit is outstanding. My secondary supervisor, Dr Stefania Paolini, made valuable theoretical contributions at important stages of my research and advised me on how to cope with the demands of thesis writing. Without their excellent contribution, this thesis would be far from finished today.

Within the School of Psychology, there are several people that helped advance my research at key moments. These include Dr Keith Harris who contributed with his knowledge on negative emotionality and the committee members of the Confirmation and Completion Seminar committees who assessed the status of my research.

A big thank you goes out to my fellow UoN students who ensured that I did not feel alone on my academic journey. I also thank my housemates for being my friends and family Down Under, and I thank my friends and family in Germany who did not forget about me in my long absence.

I would like to express my gratitude to the many research participants who volunteered to take part in my investigations. Without your participation, this thesis would not have been possible.

Finally, I would like to express my gratitude to the traditional custodians of the land on which I studied. I was fortunate enough to be welcomed by the Pambalong people and their colleagues at the university's Wollotuka institute. Elder Aunty Colleen Perry in particular is one of the most fascinating and resilient women I have ever met. May your rich cultural heritage live on another 60,000 years and beyond.

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Abstract

The Independent-Interdependent Problem-Solving Scale (IIPSS; Rubin, Watt, & Ramelli, 2012) is based on Cross, Bacon, and Morris' (2000) conceptualisation of relational-interdependent self-construal. The IIPSS provides a context-free measure of people's tendencies to solve problems independently or with the help of others. Because previous investigations did not provide extensive evidence for the reliability and validity of the IIPSS (Rubin et al., 2012; Vieira, 2013), the current research aimed to test the psychometric properties of this novel measure. A second aim of the research was to address the mental health consequences of everyday problem-solving styles. In particular, the research investigated the extent to which independent and interdependent problem-solving predicted state- and trait-based negative affect, and the extent to which these relations are moderated by the Big Five personality trait of openness to experience.

Investigations of four student samples and one sample comprised of academic researchers generally supported the reliability and validity of the IIPSS. The IIPSS yielded a single factor structure in all studies and showed adequate test-retest reliability. The IIPSS also showed predicted convergent validities with social personality traits and divergent validities with measures of demand characteristics and social desirability. With regards to the conditional effect of problem-solving style on negative affect, Studies 1 to 5 revealed that openness moderated the effect of independent-interdependent problem-solving on measures of neuroticism, depression, stress, and anxiety. Specifically, pattern of results indicated that independent problem-solving led to greater negative affect when openness was low, and interdependent problem-solving led to greater negative affect when openness was high. These results could be explained in terms of intrapersonal mechanisms in which individuals who are high in openness

tend to appraise their problem-solving abilities as high, and are therefore emotionally equipped to solve problems alone. In contrast, individuals who are low in openness tend to appraise their problem-solving abilities as low, and therefore benefit emotionally from solving problems with the help of others.

In summary, the present research shows that the IIPSS is a valid and reliable measure of people's preferences to solve general problems independently or with the assistance of others. The research also shows that both independent and interdependent problem-solving are related to negative affect among people who are low and high in openness respectively.

Chapter One: General Introduction

Overview

General Introduction to Problem-Solving

This thesis is about problems and the different approaches that people have towards solving them. My own work on this thesis has presented me with plenty of research-related problems. Some of these problems were more difficult to overcome than others. I remember an instance in which I was working on the first draft of my first experimental chapter. I realized that I was not very clear about how to put my concepts onto paper. I tried different ways of introducing and presenting previous literature but I was just not good at judging whether the way I was presenting relevant research would make sense to my readership. Finally, I sent my preliminary draft to my main supervisor for constructive criticism. He gave me valuable feedback on how to improve my work and I was very relieved to find that I was on the right track. My point here is that trying to solve the problem of writing the first chapter of my thesis on my own was exceeding my writing skills at that time. However, turning to my supervisor for help not only brought me forward academically but also resolved a major part of the stress and anxiety I was feeling as a result of not being satisfied with my draft.

The present thesis investigates the emotional consequences of individuals' general tendencies to either tackle problems on their own or to ask other people for help in the process. For example, would my experience with my first draft have been different if I had asked for help sooner and does this stubborn independent streak of mine make any difference to my emotional well-being? After all, problems are an integral part of life and so are people's reactions to them. The present thesis aims to

address these questions at the interface between how people address problems, how well they address them, and in which cases this matters emotionally.

In this introductory chapter, I introduce the main concepts discussed in the thesis. I begin by considering occurrences of independent and interdependent problem-solving in various areas of life in order to contextualize my work. I then introduce a novel psychometric scale that contrasts independent and interdependent problem-solving style. I continue by stating the main aims of the present thesis, and I explain key constructs and assumptions that I refer to throughout this thesis. I conclude the General Introduction by giving an overview of the following thesis chapters.

In the following section, I present various situations in which independent and interdependent problem-solving play an important role in political, occupational, and academic life.

Occurrence of Independent and Interdependent Problem-Solving

This thesis investigates the distinction between independent and interdependent problem-solving. Independent problem-solving occurs when people solve problems on their own and interdependent problem-solving occurs when people solve problems with the assistance of others. One real-life example of independent and interdependent problem-solving occurs in the area of public policy. Public policy strives to identify and solve problems in society (e.g., Hanberger, 2001). The policy-making process can be seen as an interplay of independent and interdependent problem-solving strategies (Bardach, 2000). As Bardach (2000) pointed out, the two main processes involved in policy making are (a) the sighting of documents (i.e., independent research) and (b) obtaining other people's suggestions (i.e., interdependent research). Thus, a practice of independent and interdependent problem-solving behaviours is needed to achieve the formulation of policies on a societal level (Bardach, 2000).

While policy-making involves independence and interdependence, the degrees to which policy-makers engage in independent and interdependent problem-solving strategies differ (Caddy & Verges, 2001; Segone, 2008). Whereas some governments put greater emphasis on independent policy-making strategies such as authority-based approaches (Segone, 2008), community engagement practices are examples in which governments actively seek advice from their citizens to formulate and decide on policies (Caddy & Verges, 2001; Carson, White, Hendriks, & Palmer, 2002). In other words, even though policy-making incorporates both independent and interdependent problem-solving strategies, governments can vary in the degree to which they promote one strategy over the other. This is important to consider because the relative preference for independent versus interdependent policy-making strategies can (a) influence policy-making success and (b) shape the general population's perception of governmental actions, for example in terms of perceived transparency of policy-decisions (Caddy & Verges, 2001; Segone, 2008).

The workplace is another area in which the identification of independent and interdependent problem-solving strategies can be useful. In workplace environments, it has been shown that employees' personal orientation towards independence or interdependence shape the degree to which they work effectively in teams (Eby & Dobbins, 1997; Ramamoorthy & Flood, 2004; Workman, 2001). Personal values of interdependence are associated with greater loyalty to team goals and cooperative team behaviours than independent orientations (Eby & Dobbins, 1997; Ramamoorthy & Flood, 2004). However, as Wagner, Humphrey, Meyer, and Hollenbeck (2012) demonstrated, teamwork in real-life settings involves tasks that are shared and tasks that are completed independently by team members. The authors found that mixed groups

comprised of employees that have independent and interdependent orientations constituted the most productive teams (Wagner et al., 2012).

Identifying the degree to which employees prefer an independent or interdependent problem-solving style may also bear important implications for occupational health. For example, an extreme preference for independent problem-solving in the workplace is highly related to workaholism. Workaholics generally need to feel in control of their work processes, and they avoid delegating tasks to their fellow co-workers (for a review, see Seybold & Salomone, 1994). These tendencies have been shown to increase stress, anxiety, and burnout in workaholics (Bonebright, Clay, & Ankenmann, 2000; Burke, 1999; Seybold & Salomone, 1994; Spence & Robbin, 1992).

Independent and interdependent problem-solving style may also be influential in university settings. Investigations of university norms have shown that American universities propagate cultural norms of independence, such as personal success, over interdependent cultural norms, such as community success (Fryberg & Markus, 2007; Stephens, Fryberg, Markus, Johnson, & Covarrubias, 2012; Stephens, Townsend, Markus, & Phillips, 2012). However, as Read, Archer, and Leathwood (2003) stated, “the ‘independent learner’ is something of a myth” in higher education (p. 272).

Research has shown that students’ success at university can be partly attributed to support from fellow students, lecturers, and mentors (Eby, Allen, Evans, Ng, & DuBois, 2008; Ramsay, Jones, & Barker, 2007; Wilcox, Winn & Fyvie-Gauld, 2005).

Therefore, the way students habitually solve their university-related problems, either on an independent or interdependent basis, is likely to shape their success and integration at university (Stephens, Fryberg, et al., 2012; Stephens, Townsend, et al., 2012).

Taken together, personal tendencies in the way that problems are approached, either on an independent or interdependent basis, influence individuals’ everyday

problem-solving experiences. Thus, preferences for independent or interdependent problem solving are likely to have implications in broader society, the work-place, and institutions such as universities that involve independent and interdependent problem-solving behaviours.

Independent and Interdependent Self-Construal

Independent and interdependent problem-solving can be related to the more general concepts of independent and interdependent self-construal (Cross, Bacon, & Morris, 2000; Cross & Madson, 1997). According to Cross et al. (2000), people differ in the way that they perceive themselves in relation to others. The self-schemata of people with independent self-construal revolve around internal attributes that are separate from others. In contrast, the self-schemata of people with interdependent self-construal include a sense of connectedness with others. Specifically, independent representations of the self include “internal and private attributes, abilities, beliefs, and characteristics that make one unique, special, and different from others” (Cross, Gore, & Morris, 2003, p. 934), whereas interdependent representations of the self include “representations of close others” (Cross et al., 2003, p. 935) such as family, friends, and partners. Therefore, Cross et al. (2003) proposed that “close relationships are essential for self-expression, self-enhancement, and self-verification” (p. 935) among individuals whose self-concepts are highly interdependent.

Cross et al. (2000) developed the Relational-Interdependent Self-Construal (RISC) scale, which measures independent and relational (i.e., interdependent) self-construal in Western societies (e.g., the United States of America or Australia). Cross et al. hypothesized that “the person who is low in interdependence may not be as likely to consider other people’s wishes or reactions or to consult other people for information or advice” (p. 799). Consistent with predictions, Cross et al. found that student

participants who had greater interdependent self-views considered the needs and opinions of their friends and family members more when making important decisions than participants who had greater independent self-views. In the same way that independent and interdependent self-views seem to be accentuated between individuals in similar situations, individuals may also differ in their general independent and interdependent problem-solving orientations. Thus, a measure that assesses the degree to which individuals solve their problems independently or with the help of others has the potential to contribute to the broader research that has investigated independent and interdependent self-construal.

The Independent and Interdependent Problem-Solving Scale

Based on Cross et al.'s (2000) prior work, Rubin, Watt, and Ramelli (2012) assumed that people with greater independent self-views would be more likely to prefer independent problem-solving and people with greater interdependent self-views would be more likely to prefer interdependent problem-solving. Rubin et al. designed a novel measure to assess the proposed individual differences in the preference for independent or interdependent problem-solving styles. The Independent-Interdependent Problem-Solving Scale (IIPSS; Rubin et al., 2012) provides a relatively context-free measure of "individual differences in the tendency to work on one's own or seek help from others to solve problems and achieve goals" (Rubin et al., 2012, p. 7). An example item for independent problem-solving is "When faced with a difficult personal problem, it is better to decide yourself rather than to follow the advice of others," and an example item for interdependent problem-solving is "I usually find other people's advice to be the most helpful source information for solving my problems" (Rubin et al., 2012, online supplemental material).

Although the concept of interdependent problem-solving is not new (e.g., Fischer & Turner, 1970; Garland & Zigler, 1994; Karabenick & Knapp, 1991; Kessler, Reuter, & Greenley, 1979; Pajares, Cheong, & Oberman, 2004), Rubin et al.'s (2012) measure of independent and interdependent problem-solving styles is distinctive because (a) it focuses on whether or not people tend to ask others for advice on how to solve their problems, (b) it is the only measure to assess a *general* preference to engage in help-seeking (i.e., not tied to a specific context, such as an educational or health context), and (c) it is the only measure to contrast the preference for independent problem-solving with the preference for interdependent problem-solving. Typically, help-seeking scales assess whether individuals seek help or not. Those measures do not specify what individuals do if they do not seek help (e.g., try to solve the problem on their own, or avoid seeking a solution altogether). The IIPSS differs from these previous help-seeking scales in that it contrasts a preference for independent problem-solving with a preference for interdependent problem-solving and assesses the extent to which individuals prefer to solve their problems on their own when they do not seek help.

The initial version of the IIPSS consisted of 12 items, including six that measured independent problem-solving and six that measured interdependent problem-solving (Rubin et al., 2012). Rubin (2011c) revised the IIPSS to produce a second version that consisted of 10 items and that had more concise instructions. One item measuring independence and one item measuring interdependence were deleted from the original scale and the instructions were shortened for Version 2 of the IIPSS. I intended to use this revised version in the present research.

In the following section, I present previous research that employed the IIPSS in the area of social psychology and consumer psychology. I point out two limitations of those earlier studies that I addressed in the present thesis.

Previous Research that has Used the IIPSS

The role of independence versus interdependence has been examined in areas such as relational-interdependent self-construal and individualism-collectivism (e.g., Cross et al., 2000; Cross & Madson, 1997; Killen & Wainryb, 2000; Markus & Kitayama, 1991). However, very little research has considered how these factors influence problem-solving (Rubin et al., 2012; Vieira, 2013).

In an initial investigation, Rubin et al. (2012) demonstrated how the IIPSS could be used to predict social integration among immigrants. In particular, Rubin et al. investigated the moderating effect of interdependent problem-solving on the relation between approach/avoidance orientation and social integration among immigrants in Australia. In a sample of 137 Australian immigrants, Rubin et al. found that approach orientation was positively related to social integration for independent problem-solvers but not for interdependent problem-solvers. Hence, the authors showed that the relation between people's approach orientation and social integration was reduced if immigrants preferred to seek help from other people to achieve social integration into the new country (i.e., interdependent problem-solvers).

Vieira (2013) showed that the IIPSS was related to consumers' need for touch and the desire for unique consumer products. In the area of consumer psychology, need for touch describes the preference for assessing information with the utilization of one's haptic system. Vieira explained that, "by using the haptic system, consumers can obtain product information and use it to make better judgments" (p. 482). In a sample comprised of 79 graduate business students, independent problem-solving style had a

moderate and positive correlation with participants' desire for touching a product prior to purchase. In other words, independent problem-solvers expressed a greater tactile need to inspect a sales item than interdependent problem-solvers. In addition, the desire to purchase unique consumer products moderated the relation between problem-solving style and need for touch. When the desire for unique consumer products was low, independent problem-solving was negatively related with participants' need for touch. However, when the desire for unique consumer products was high, the effect turned around in that independent problem-solving was positively related with participants' need for touch. These results indicated that differences in problem-solving style and the desire for unique products influenced the way consumers made purchasing choices.

Two relevant issues were not addressed in these earlier investigations. First, the psychometric properties reported by Rubin et al. (2012) concerned Version 1 of the IIPSS. Rubin (2011c) since modified the initial version. Although Vieira (2013) tested the factor structure and internal reliability of Version 2 of the IIPSS, the psychometric properties of this revised version have not been established more extensively, especially with respect to the validity of the measure. Second, prior investigations regarding problem-solving style considered theoretical issues in the areas of social integration and consumer behaviour (Rubin et al., 2012; Vieira, 2013). However, these previous examinations did not assess the emotional effects of problem-solving style. The current investigation aimed to overcome these two shortcomings.

The Two Main Aims of the Present Thesis

Aim I

The present thesis has two main aims. The first aim is to examine the psychometric properties of Version 2 of the IIPSS. As stated previously, contrasting independence versus interdependence in the area of everyday problem-solving may help

to explain differences in relation to gender, personality, and social class. However, the reliability and validity of the newly developed IIPSS needs to be established in order to ensure that the measure captures the underlying construct it intends to measure.

Therefore, I aimed to examine the internal consistency, factor structure, and test-retest reliability of Version 2 of the IIPSS. To confirm the validity of the IIPSS, I also aimed to examine whether it showed the expected correlations with measures of relational-interdependent self-construal, collaboration in decision-making, help-seeking, and help-seeking threat. I further aimed to examine whether the IIPSS is unrelated to measures of demand characteristics, social desirability, and help-seeking avoidance.

Aim II

The second aim of my thesis is to examine the mental health implications of problem-solving style. Does an independent or interdependent problem-solving style lead to more negative mental outcomes? To investigate this issue, I focused on the relation between problem-solving style and the Big Five personality trait of neuroticism as well as more state-based measures of depression, anxiety, and stress.

My second aim also involved considering processes that may potentially ameliorate negative relations between problem-solving style and mental health outcomes. In particular, I examined the extent to which the relations between problem-solving style and feelings of negative emotionality (neuroticism, depression, anxiety, stress) are moderated by individual differences in openness to experience.

Openness to experience is a Big Five personality trait that assesses cognitive engagement (see DeYoung, 2014) and has been shown to be related to positive problem-solving and self-efficacy appraisals (Bouchard, 2003; Hartman & Betz, 2007; McMurrin, Egan, Blair, & Richardson, 2001; Moberg, 2001; Nauta, 2004; Penley & Tomaka, 2002; Rottinghaus, Lindley, Green, & Borgen, 2002). In the current thesis, I

aimed to test whether openness helps determine when an independent or interdependent problem-solving style predicts greater negative emotional effects.

I should note at this stage that my initial Aim II was to investigate the moderating effect of problem-solving style on the relation between personality and performance. Analyses of the first four studies revealed that this line of investigation did not yield conclusive or replicable results. However, post hoc exploration of the four data sets revealed an alternative significant and replicable finding that informed the relation between problem-solving style and negative emotionality. Consequently, and in order to make a significant contribution to the existing research in this area, I changed the focus of my second research aim in order to describe the alternative robust effect that emerged from my investigations. Hence, my investigations regarding my research Aim II, as it is presented in this thesis, were post hoc and exploratory in nature for Studies 1, 2, 3, and 4. However, in my fifth study, I provide an a priori test for Aim II.

In summary, although previous research has demonstrated the usefulness of independent versus interdependent problem-solving in relation to social integration and consumer behaviour (Rubin et al., 2012; Vieira, 2013), the present thesis expands on prior research in that it investigates (a) the reliability and validity of a novel measure of problem-solving style and (b) the mental health impact of problem-solving style.

In the following section, I introduce key constructs that I used throughout the present thesis. In particular, I discuss the types of problems that I considered in the present thesis and the specific meaning of problem-solving style.

An Explanation of Key Constructs

Type of Problems

As mentioned previously, people encounter a wide range of problems in their everyday lives. Many of these problems address the individual and can be solved either

independently or with the help of others. Jonassen's (2000) classification of problem-solving *types* provide examples of the kinds of problems that individuals may recall when asked for their typical problem-solving behaviours. Decision-making problems such as "should I move in order to take another job?" require individuals to identify one preferable option out of several alternative options and to justify their decision. Other problem-solving types such as troubleshooting tasks (e.g., "why does my car not start?") require individuals to know the system requirements and to form hypotheses about the faults within the system in order to restore the system's functions. Each of these problem types, although diverse in nature, can be solved independently or with assistance of other people.

Because I aimed to assess *personal preferences* for independent versus interdependent problem-solving, the current investigation was limited to types of problems that were (a) relevant to individuals rather than groups and (b) potentially independent or interdependent (viz., problems that could be solved on one's own or with the assistance of other people). For example, I was interested in personal problems such as "what do I need to pack for my upcoming trip?" rather than group problems such as "how can we, as a team, make sure that we take everything we need on our trip?" In addition to personal problems, I was interested in problems that had the potential to be solved with the help of others. Most personal problems can either be solved independently or with the help of others. So, for example, the question of "what do I need to pack for my upcoming trip?" can be answered via individual study (i.e., searching the internet) or by consulting with someone who can give advice (i.e., asking a friend with travel experience). It is important to note that the concept of interdependent problem-solving does not target the sociality of the problem (i.e., whether a problem is social in nature). Instead, interdependent problem-solving was

designed to assess whether individuals have a general tendency to seek assistance in problematic situations (Rubin et al., 2012). To illustrate this difference, the IIPSS captures whether individuals tend to solve relationship problems (i.e., relational problems) and mathematical problems (i.e., scholarly problems) alone or with the help of others.

The current research encompassed types of problems that occur in everyday living such as in one's private, work-related, or academic living environments. As Berg, Meegan, and Klaczynski (1999) described, everyday problem-solving is the act of "solving problems that are frequently encountered in daily life, that are complex and multidimensional, and that are often ill-structured as to their goals and their solution" (pp. 615). Strough, McFall, Flinn, and Schuller (2008) pointed out that, although much of the everyday problem-solving literature has focused on individual problem-solving processes, everyday problem-solving often occurs with the help of other people. In the current research, I aimed to examine whether individuals prefer to address everyday problem-solving tasks self-sufficiently or with the help of other people. The specific problems considered in the present research were everyday problem-solving scenarios that individuals thought of by themselves with minimal instructions. This minimal guidance enabled me to examine individual differences in problem-solving styles across a large possible range of problems, hence facilitating the generalizability of results. This approach distinguished the current research from other investigations that focussed more closely on specific types of problems and problem-solving areas (e.g., Karabenick & Knapp, 1991; Kessler et al., 1979; Pajares et al., 2004).

In summary, I was interested in the ways individuals approached a variety of everyday problems that could potentially be solved independently or with the help of others. Those problems could arise in private, academic, or occupational settings.

Problem-Solving Style

Problem-solving *style* refers to “a relatively stable preference an individual expresses when approaching problems, considering information, and making decisions” (Houtz & Selby, 2009, p. 18). This definition implies that a person’s problem-solving *style* remains relatively stable across different problem-solving *types* because a person’s habitual style is a person-based variable that is considered to carry across situational circumstances (see Houtz & Selby, 2009). However, related research suggests that problem-solving style can change over the life course and can be altered through training (Pezzuti, Artistic, Cervone, Tramutolo, & Black, 2009; Strough et al., 2008), indicating that styles can change with age and circumstances and can be altered via interventions.

In the present research, I contrasted two problem-solving styles: independent problem-solving and interdependent problem-solving. Unless specifically noted, I used the shortened form of *problem-solving style* to refer to independent-interdependent problem-solving style throughout the thesis.

Key Assumptions Presented in this Thesis

In this section, I explain the key assumptions that I make in the thesis. These assumptions refer to my research Aim II. In particular, I present previous research showing that (a) problem-solving style is related but not equivalent to problem-solving ability, and that (b) the trait measure of neuroticism is a valid dependent measure of negative emotional experiences.

Contrasting Problem-Solving Style and Problem-Solving Skill

An individual’s problem-solving style is distinct not only from the *type* of problems that individuals encounter but also from a person’s problem-solving *skill* in that a problem-solving style is not inherently indicative of problem-solving success. A

real-life example of a mismatch between problem-solving style, problem-solving ability, and the problem-solving context was recently reported in Canadian news outlets (“Discovery-based Math Blamed for Declining Skills,” 2015, May 29; McQuigge, 2015, May 27; “Report Finds Discovery Based Learning to Blame,” 2015, May 28). In Canadian schools, students were required to solve a certain number of mathematical problems on their own, based on individual discovery, without being able to ask their teacher for guidance. The aim of this requirement was to foster independent mathematical problem-solving skills in school children. However, students’ math grades declined as a consequence of independent learning requirements. To explain the reasons behind this decline in grades, it was proposed that an independent mode of solving novel mathematical problems could only be successful if the learner was already familiar with mathematical knowledge and had an pre-established skillset for applying this knowledge (“Report Finds Discovery Based Learning to Blame,” 2015, May 28). In other words, school children who were still being introduced to mathematical concepts were not able to solve novel mathematical problems self-sufficiently. As this example illustrates, even a problem-solving style, such as independent discovery, that is generally associated with problem-solving ability in the area of mathematics can fail to provide the desired outcome under certain circumstances and is thus not a guarantor for problem-solving success.

Considering interindividual differences in problem-solving style over and above individuals’ problem-solving skills can increase the predictability of difficulties in the problem-solving process. Difficulties in the problem-solving process can occur when one’s preferred problem-solving style is relatively incompatible with the type of problem to be solved or the situation in which the problem needs to be solved. For example, Houtz and Selby (2009) described a problem-solving situation that required

teamwork in order to be completed. If a person's problem-solving style is predominantly independent, then this person is likely to experience more difficulties compared to team members who engage in interdependent problem-solving more regularly. As Houtz and Selby pointed out, "individuals with qualitatively or sharply different preferences may be more or less able to adapt to the conditions, limitations, and/or possibilities for solutions inherent in different problem types and environments" (p. 19). Therefore, a relative mismatch between a person's problem-solving style, the types of problems to be solved, as well as the conditions under which problems are being solved (e.g., in a group setting or solitary space) could present an obstacle in the problem-solving process and thus hinder problem-solving success, irrespective of one's general ability to solve problems.

In summary, although problem-solving style has implications for problem-solving success, I regarded problem-solving style and problem-solving ability as separate constructs in the current thesis. This approach is in line with previous literature (e.g., Chartrand, Rose, Elliott, Marmarosh, & Caldwell, 1993; D'Zurilla, Chang, Nottingham, & Faccini, 1998; Houtz & Selby, 2009).

Neuroticism as a Dependent Variable

A second key assumption in my work is that neuroticism can be treated as an outcome variable that represents trait-based negative emotionality. This approach is similar to investigations that conceptualize neuroticism as "trait anxiety" (e.g., Jorm, 1989; Munafò, Clark, & Flint, 2005; Schinka, Busch, & Robichaux-Keene, 2004).

Among the Big Five traits, neuroticism is considered the "emotional" dimension (for an overview, see John & Srivastava, 1999; Lahey, 2009). As Lahey (2009) pointed out, "neuroticism is operationally defined by items referring to irritability, anger, sadness, anxiety, worry, hostility, self-consciousness, and vulnerability that have been

found to be substantially correlated with one another in factor analyses” (p. 241). Thus, the trait measure of neuroticism subsumes frequent experiences of negative affect in everyday living (Bouchard, 2003). In line with this interpretation, researchers found that individuals with high levels of neuroticism responded with negative emotions to problems and were insecure about whether they could meet personal challenges (McCrae & Costa, 2003; Watson, Clark, & Harkness, 1994, as cited in Lahey, 2009).

In the present thesis, I assumed that neuroticism, although classified as a personality trait, is suitable for assessing the degree of negative emotionality in individuals. My approach is consistent with that of other researchers who have used neuroticism as a dependent variable (e.g., Beech, 2001; Engeli et al., 2014; Farmer et al., 2002; Goodwin & Hamilton, 2002; Zanon & Hutz, 2013). For example, Beech (2001) investigated increased levels of neuroticism as a result of hair loss in men, and Farmer et al. (2002) demonstrated that current negative mood (i.e., depressive symptoms) was a significant predictor of neuroticism scores. Interestingly, age, gender, and negative mood in the past are also relevant predictors for neuroticism but to a lesser degree than current negative mood (Farmer et al., 2002; see also Kendell & DiScipio, 1968; Katz & McGuffin, 1987, as cited in Farmer et al., 2002). Hence, neuroticism appears to be sensitive to changes in negative emotionality (Beech, 2001; Enns et al., 2006) as well as to current experiences of negative emotionality (Farmer et al., 2002).

In summary, I assumed that neuroticism was suitable to function as a dependent variable in my investigations because (a) neuroticism has been shown to be a relevant factor in problem-solving situations (McCrae & Costa, 2003; Watson, Clark, & Harkness, 1994, as cited in Lahey, 2009), and (b) it has been shown to represent current negative moods more so than negative emotions of the past (see Farmer et al., 2002).

Overview of the Thesis

The present thesis contains eight chapters, five of which report the results of empirical studies. Following the current introductory chapter, I provide a review of the current literature concerning problem-solving and person-based variables of openness to experience, positive problem-solving approaches, and self-efficacy in Chapter 2. In Chapter 3, I present the first empirical investigation in which I (a) examined the psychometric properties of the IIPSS and (b) demonstrate the interactive effect of openness and problem-solving style on the emotional trait measure of neuroticism among undergraduate students. In Chapter 4, I replicate the results I found in Study 1 in a similar sample comprised of undergraduate student participants and demonstrate that the IIPSS and the interaction effect between openness and problem-solving style cannot be explained by tendencies to respond in socially desirable ways. In Chapter 5, I replicate similar trends of results I found in Study 1 among academic researchers. In Chapter 6, I focus on a more extensive evaluation of the psychometric properties of the IIPSS. I further reproduce the interaction effect between openness and problem-solving style with a measure of social support seeking and measures of depression, anxiety, and stress that also tap into the proposed constructs of problem-solving style and negative emotionality. In Chapter 7, I focus on examining the interaction effect between openness and problem-solving style on an a priori basis and test the assumptions that I proposed in Chapter 3 in order to explain the interaction effect. In Chapter 8, I conclude with a general discussion of the research findings relating to the usefulness of the IIPSS and the theoretical and applied implications of the interactive effect of problem-solving style and openness on state- and trait-based negative affect.

Chapter Two: Literature Review

Introduction to the Current Literature Review

In this chapter, I present a critical review of the literature concerning problem-solving in everyday living. The broader research areas of (a) solving problems in the real world, (b) the role of interpersonal support in problematic situations, and (c) personal problem-solving ability are generally widely studied. I found that much of the literature within those areas tends to cluster around specific topics such as everyday problem-solving in old age, social support among people with mental illness, and cognitive problem-solving ability. For the purpose of the present thesis, I narrowed my search to include literature that corresponds to my research aims as presented in Chapter 1. Aim I concerns the psychometric properties of the second Version of the IIPSS. Aim II concerns the negative emotional effects of independent problem-solving and how openness to experience alleviates these negative emotions.

I begin my literature review by presenting prominent conceptualisations of everyday problem-solving and embed the current investigation into relevant previous literature that used these conceptualizations. Relating to Aim I, I present measures of interpersonal problem-solving and elaborate on similarities and differences between these measurement tools and the IIPSS. I further present initial findings on the reliability and validity of the IIPSS in previous investigations. Relating to Aim II, I present previous literature on the mental health implications of independent and interdependent problem-solving. I further present previous literature demonstrating the stress-relieving effect of openness to experience.

Solving Problems in Everyday Living

Different Types of Problem-Solving

In the present section, I provide a brief overview of current research streams that assess everyday problem-solving. In particular, I identified three current research streams in psychology that contributed a large bulk of the everyday problem-solving literature, namely the areas of (a) everyday problem-solving, (b) personal problem-solving, and (c) social problem-solving.

Everyday problem-solving. Everyday problem-solving has been examined in terms of differences between types of problems, individual characteristics, and the problem-context (e.g., Allaire & Marsiske, 2002; Berg et al., 1999; Blanchard-Fields, 2007; Cornelius & Caspi, 1987). As mentioned in Chapter 1, everyday problem-solving refers to “solving problems that are frequently encountered in daily life, that are complex and multidimensional, and that are often ill-structured as to their goals and their solution” (Berg et al., 1999, pp. 615). As Allaire and Marsiske (2002) pointed out, everyday problem types vary in their degree of structure, ranging from well-defined problems to ill-defined problems. For example, the Everyday Problems Test (Willis & Marsiske, 1993) assesses well-structured problems with one possible solution that occurs in everyday life such as interpreting information correctly from real-life charts and tables that refer to financial and household matters. Ill-structured problems are more ambiguous and may entail several possible strategies and problem-solutions. Therefore, ill-structured problems are generally presented in open-ended hypothetical situations that mimic real-life situations (e.g., Berg et al., 1999; Blanchard-Fields, 2007). For example, Berg et al. (1999) presented participants with hypothetical scenarios about a dinner party or a doctor’s visit. Participants responded to questions regarding the identification of the problem and strategies about how to solve the problem effectively.

Another dimension along which everyday problem types vary is along their instrumental versus interpersonal or emotional content (Blanchard-Fields, 2007; Blanchard-Fields, Jahnke, & Camp, 1995). For example, Blanchard-Fields et al. (1995) asked participants how they would solve interpersonal problems such as placing a parent into a nursing home. Blanchard-Fields et al. further asked participants how they would solve instrumental problems such as returning a faulty item.

Other areas of interest within everyday problem-solving research concern the question of how person-based characteristics and contextual factors influence problem-solving (e.g., Meegan & Berg, 2002; Patrick & Strough, 2004; Thornton & Dumke, 2005; Willis, 1996). Willis (1996) argued that everyday problem-solving encompasses an individual's cognition, efficacy, emotionality, belief system, and contextual factors. A review on everyday problem-solving ability and efficacy suggested that person-based variables that influence problem-solving remained stable across the adult life span until late adulthood (Thornton & Dumke, 2005). In their meta-analytic review, Thornton and Dumke (2005) found that younger and middle-aged adults solved problems efficiently and with confidence. In older adults, however, problem-solving ability and confidence declined. Interestingly, the decline in problem-solving ability was less pronounced for interpersonal problems as compared to instrumental problems (Thornton & Dumke, 2005). In line with this finding, Meegan and Berg (2002) found in their review on collaborative everyday problem-solving that older adults found better solutions to problems when they were solving problems on an interpersonal basis rather than on an individual basis, especially when problems were being solved with close others (e.g., one's spouse) than with unknown others. Patrick and Strough (2004) demonstrated that help-seeking was related to more flexibility and confidence in old age. In particular, the authors showed that older adults were more likely to consider moving house when they

were willing to seek assistance from other people compared to older adults who were not willing to seek assistance for relocation purposes. In summary, these findings suggested that person-based characteristics such as problem-solving ability, flexibility, and efficacy as well as contextual factors such as the assistance from other people influence the problem-solving process and outcome throughout the adult life span.

In the present thesis, I examined the emotional consequences of independent versus interdependent problem-solving in younger and middle-aged adults. I further examined whether a positive problem-solving orientation and self-efficacy influenced the relations between problem-solving style and negative emotionality. However, I did not distinguish between well- and ill-defined problems. I further did not examine personal belief systems, and I did not examine emotional effects of problem-solving style in older age.

Personal problem-solving. Personal problem-solving (also called *applied problem-solving*) and social problem-solving are conceptualized to inform counsellors on their clients' applied problem-solving behaviours and appraisals (D'Zurilla & Nezu, 1999; Heppner & Krauskopf, 1987). Due to the clinical orientation of these real-life problem-solving streams, both personal and social problem-solving contrast people's objective presence of a problem with their subjective perception of the problem (see Heppner & Krauskopf, 1987). Heppner and Krauskopf (1987) defined personal problem-solving as "rational and irrational, conscious and unconscious processes, as well as the cognitive, affective, and behavioural processes, in which clients engage as they cope with their personal difficulties prior to and during counseling" (p. 376). Heppner and Krauskopf pointed out that the concept of personal problem-solving differs from the concept of social problem-solving, as described by D'Zurilla and colleagues, in one important point. In contrast to the concept of social problem-solving, which I

further present in the following subsection, personal problem-solving attempts to explain clients' problem-solving efforts in its complex nature and does not look to model the problem-solving process in order to facilitate the creation of intervention programs (see Heppner & Krauskopf, 1987; Heppner, Witty, Dixon, 2004).

Similar to everyday problem-solving, the conceptualisation of personal problem-solving differentiates between different problem-solving types such as routine versus creative problems and formal versus informal problems (Heppner & Krauskopf, 1987). For example, comparable to well-structured problems, formal problems concern specific problems with a relatively clear problem-solving process and goal such as solving mathematical problems. Comparable to ill-structured problems, informal problems concern unspecific personal problems that are more ambiguous in nature than formal problems and may concern interpersonal matters such as deciding on whether to marry one's partner (see Heppner & Krauskopf, 1987).

A prominent psychometric scale for personal problem-solving is the Problem Solving Inventory (Heppner, 1988; Heppner & Peterson, 1982). The Problem Solving Inventory assesses individuals' appraisals of their problem-solving skill and style. In particular, the measure distinguishes between individuals' perceived problem-solving confidence, personal control, and an approach versus avoidance style to solving problems.

In their meta-analytical review of research findings relating to the Problem Solving Inventory, Heppner et al. (2004) recommended that researchers should "examine more multifaceted models that include moderators, mediators, and structural paths between problem-solving appraisal and indices of psychological and physical health [...]" (p. 403). Indeed, several studies examining psychological distress in applied problem-solving situations have shown that multifaceted models of problem-

solving advance knowledge on linear relations between personal problem-solving and mental health. For example, three studies employing the Problem Solving Inventory found that personal control mediated the relation between individuals' approach-avoidance style and measures of psychological distress (e.g., depression and anxiety) in samples comprised of American and South African university students and patients with chronic back pain (Heppner & Lee, 2002; Heppner, Pretorius, Wei, Lee, & Wang, 2001; Witty, Heppner, Bernard, & Thoreson, 2001). These findings indicated that problem-solving style (i.e., approach-avoidance style) was not directly associated with psychological distress. Instead, individuals' avoidance style only led to negative affect when their problem-solving efficacy (i.e., personal control appraisal) was low.

Other research on personal problem-solving has investigated the relation between personal problem-solving appraisals and help-seeking behaviours. For example, studies on the relation between personal problem-solving and the use of student services such as seeking help from individual tutors and on-campus advisors has shown that students with higher levels of problem-solving self-efficacy reported using more student services than students who felt less confident in their problem-solving skills (Neal & Heppner, 1986; Tracey, Sherry, & Keitel, 1986; see also Heppner et al., 2004). In addition, studies have shown that patients with spinal cord injuries who had high levels of perceived problem-solving self-efficacy reported to benefit most from resources provided by friends, whereas patients who had low levels of self-efficacy reported to benefit most from resources provided by professional staff (Elliott, Herrick, & Witty, 1992; see also Heppner et al., 2004). Heppner et al. (2004) concluded their review on this and related research findings by stating that, "not only may there be differences in levels of social support across levels of problem-solving appraisal, but the interaction of these two resources may affect coping and psychological adjustment" (p.

386). Hence, the authors assumed that the interplay between personal problem-solving appraisals and social support affect mental health outcomes.

In summary, investigations on personal problem-solving have demonstrated that problem-solving skill and style influence mental health and the use of help-seeking sources in complex ways. In the current thesis, I investigated how markers of problem-solving ability and self-efficacy moderate the relation between problem-solving style and negative affect. Similar to recommendations made by Heppner et al. (2004), I aimed to examine possible mediators and moderators of this relation. However, the current thesis differs from the personal problem-solving research presented here in that I aimed to examine the conditions under which an independent-interdependent problem-solving style (as opposed to an approach-avoidance style) holds consequences for mental health.

Social problem-solving. Another prominent area that assesses problem-solving in the real world is social problem-solving. D’Zurilla and Nezu (1982) defined social problem-solving as “the self-directed cognitive-behavioural process by which an individual, couple, or group attempts to identify or discover effective solutions for specific problems encountered in everyday living” (p. 12). Even though the term *social* problem-solving refers to problems with an interpersonal component, social problem-solving relates to multiple problem types and situations of which interpersonal problems are just one example (D’Zurilla, Maydeu-Olivares, & Kant, 1998; D’Zurilla & Nezu, 1982). Hence, the broad consideration of multiple problem-solving types is comparable to propositions made in the areas of everyday problem-solving and personal problem-solving that I presented in the previous subsections.

In their theory on social problem-solving, D’Zurilla and Goldfried (1971) proposed the existence of five problem-solving processes. These are (a) general

orientation, (b) problem-solving definition and formulation, (c) generation of alternatives, (d) decision-making, and (e) verification. On the basis of their problem-solving model, D’Zurilla and colleagues created problem-solving interventions to facilitate effective problem-solving strategies. These interventions were targeted to foster positive behavioural and emotional consequences in clients (see Bell & D’Zurilla, 2009; D’Zurilla, 1988; D’Zurilla & Goldfried, 1971; Heppner & Hillerbrand, 1991). A critical assumption of the social problem-solving model is that two partially-independent processes determine everyday problem-solving outcomes. The first process is problem-solving orientation, which describes a general motivational orientation towards solving a problem. The second process is problem-solving style, which describes cognitive and behavioural actions employed in the problem-solving process. A prominent measure that assesses these facets is the Social Problem Solving Inventory (D’Zurilla. & Nezu, 1990; D’Zurilla, Nezu, & Maydeu-Olivares, 2002). The revised Social Problem Solving Inventory (D’Zurilla et al., 2002) consists of five dimensions, two of which describe problem-solving orientation (i.e., positive and negative problem orientation), and the remaining three dimensions describe problem-solving style (i.e., rational problem-solving, impulsivity/ careless style, and avoidance style). High levels of positive problem orientation and rational problem-solving are described as markers for functional problem-solving, whereas high levels of negative problem orientation, impulsivity/ carelessness, and an avoidance style are described as markers of dysfunctional problem-solving. Higher scores on the overall scale indicate greater problem-solving ability.

Within the social problem-solving model, it is assumed that “much of what is viewed as ‘psychopathology’ can often be understood as ineffective and maladaptive coping behavior leading to various personal and social consequences, such as

depression, anxiety, anger, interpersonal difficulties, and physical symptoms” (Nezu, Wilkins, & Nezu, 2004, p. 57; see also Nezu & D’Zurilla, 1989). In line with this assumption, scores on the Problem Solving Inventory indicating dysfunctional problem-solving approaches showed strong correlations with stress, depression, anxiety, worry, and suicide ideation across student, adult, and clinical samples (for an overview, see Nezu et al., 2004). Furthermore, Nezu et al. (2004) stated in their review on the relation between social problem-solving and mental health that “continued successful problem-solving attempts are likely to reduce or minimize one’s immediate emotional distress (e.g., depressive symptomatology) in reaction to a stressful event, as well as to attenuate the probability of long-term negative affective outcomes (e.g., depressive disorder)” (p. 58). In support of this assumption, previous research has demonstrated that effective problem-solving prevents negative psychological and physiological consequences of stressful life events (Aldao, Nolen-Hoeksema, & Schweizer, 2010; D’Zurilla & Sheedy, 1991; Nezu et al., 2004). For example, D’Zurilla and Sheedy (1991) found that first-year university students’ overall Social Problem Solving scores negatively predicted future experiences of stress, indicating a stress-relieving effect of effective social problem-solving. These results persisted after controlling for participants’ preceding experiences of stress and number of problems. In addition, effective problem-solving has been shown to moderate the relation between stressful life events and negative affect such as depression and anxiety across student, adult, and clinical samples (for an overview, see Nezu et al., 2004). Indicating the validity of these findings, the interactive effect of effective problem-solving and stressful life events on negative affect persisted in investigations that employed the Problem Solving Inventory as a measure of effective problem-solving appraisals (Bonner & Rich, 1988; Ciarrochi & Scott, 2006; Nezu & Ronan, 1988).

Similar to the aforementioned investigations on social problem-solving, I also sought to investigate the stress-relieving effect of effective problem-solving approaches in the present thesis. However, because my research Aim II was amended after the results for Studies 1, 2, 3, and 4 were known, I used alternative measures to examine the stress-relieving role of effective problem-solving appraisals. In particular, I proposed that openness to experience is a marker for positive problem-solving orientation and self-efficacy and thus reduces negative feelings in independent problem-solvers. I was further interested in examining the mental health consequences of an independent versus interdependent problem-solving style, as opposed to the mental health consequences of stressful life events presented in the previous section. Furthermore, although the definition of social problem-solving subsumes problem-solving processes in individuals, dyads, and groups, I only focus on individual problem-solving processes in the present thesis.

Independent and Interdependent Forms of Problem-Solving

In the present section, I briefly summarized common measures of independent and interdependent forms of solving problems and compared them to the IIPSS. I conclude this section with an explanation about why the IIPSS is a valuable addition to existing range of psychometric tools that measure independence and interdependence in problem-solving situations.

Self-construal. As mentioned in the previous chapter, the IIPSS is based on Cross et al.'s (2000) RISC scale, which assesses relational-interdependent self-construal in Western societies. In particular, the RISC scale aims to distinguish individuals who form relational self-construals and seek contact with close relationship partners. An example item for relational-interdependent self-construal is, "when I establish a close friendship with someone, I usually develop a strong sense of identification with that

person.” In contrast to the RISC scale, the IIPSS focuses specifically on problem-solving rather than the broader concept of relationship orientation. For interdependent problem-solvers, this includes consulting with other people who may not be close acquaintances (e.g., “I usually prefer to ask other people for help rather than to try to solve problems on my own”). In addition, only one of the eleven RISC scale items directly assesses independent self-construal (“My close relationships are unimportant to my sense of what kind of person I am”). For all other items, it is assumed that low scores on the RISC scale represent independent self-construal. In contrast, the IIPSS presents a balanced number of items that assess independent problem-solving style and interdependent problem-solving style.

Interpersonal coping. The revised version of the Ways of Coping scale (Folkman, Lazarus, Dunkel-Schetter, & DeLongis, 1986) measures eight forms of problem- and emotion-based coping strategies. Coping is described as “constantly changing cognitive and behavioral efforts to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person” (Lazarus & Folkman, 1984, p. 141). Two of the coping options described in the revised Ways of Coping scale, namely planful problem-solving and seeking social support, assess similar facets to those of the IIPSS. An example item for planful problem-solving is “draw on my past experiences; I was in a similar situation before.” An example item for seeking social support is “ask a relative or friend I respect for advice.” However, there are also important differences to be noted. The revised Ways of Coping scale is based on the concept of cognitive appraisals, a theoretical approach that describes people’s evaluation processes regarding current situations. It primarily evaluates people’s reactions to particularly stressful events, whereas the IIPSS can be applied to a wide variety of tasks that may or may not evoke stress. In addition, the IIPSS focuses on

information-based problem solving and is distinct to the revised Ways of Coping scale in that it specifically contrasts independent and interdependent problem-solving styles.

Like the IIPSS, the Relational, Individual, and Collective Coping Scale (Hardie, Critchley, & Morris, 2006) is conceptually based on relational-interdependent self-construal theory. The Relational, Individual, and Collective Coping Scale measures the extents to which individuals habitually cope with stressful situations by themselves, by turning to close others, or by turning to groups. An example item for individual coping is “I try to grow as an individual from the experience,” and an example item for relational coping is “I seek understanding from a close friend/significant other.” Unlike the IIPSS, which assesses general preferences for independence or interdependence in problem-solving situations, the Relational, Individual, and Collective Coping Scale measures the general use of independent, interdependent, and collective *coping strategies*. These coping strategies relate to the ways in which individuals gain strength and grow from stressful situations (see Hardie et al., 2006). However, as stated in the previous paragraph, the IIPSS does not specifically address how individuals react to stressful encounters to relieve stress. Instead, the IIPSS refers to problem-solving situations more broadly. It assesses whether problems are being approached independently or with the help of others, regardless of how stressful the problematic situation may be perceived.

Social provisions and social support. The IIPSS also differs from measures of social provision such as the Social Provisions Scale (Cutrona & Russell, 1987). Weiss (1974) distinguished between six social provisions that describe specific functions of social relationships: attachment, reassurance of worth, reliable alliance, social integration, opportunity for nurturance, and guidance. Like the IIPSS, the guidance subscale measures interpersonal problem-solving. An example item for guidance

is “There is someone I could talk to about important decisions in my life.” However, in contrast to the IIPSS, the social provisions model assumes that individuals who refrain from seeking guidance lack an adequate social network. This notion is reflected in the negatively worded items of the guidance subscale. For example, the item “there is no one I can turn to for guidance in times of stress” aims to assess the availability of social support, rather than a personal preference to seek out help or solve problems in a self-reliant fashion. Hence, the IIPSS is distinct from the guidance subscale in that it measures a general preference for independent versus interdependent problem-solving.

The IIPSS is also distinct from measures that assess social support. Social support can be either emotion-based to assist people in positive coping with stress that is related to a specific task, or it can provide information relevant to the completion of the task in question (e.g., Harlow & Cantor, 1995). Measures of social support reflect this distinction. For example, the Social Support Questionnaire (Sarason, Levine, Basham, & Sarason, 1983) asks respondents to complete statements that refer to both kinds of social assistance and quantifies one’s perceived satisfaction with social support networks. An example item for social support that relates to interdependent problem-solving is “Whom can you really count on to give you useful suggestions that help you to avoid making mistakes?” Respondents indicate to how many people they know that they can turn to for this kind of problematic situation and how satisfied they are with this circumstance. However, respondents are explicitly instructed to exclude themselves as a source of help and support. Hence, similar to measures of social provisions, the IIPSS differs from social support measures in that it is not seeking insights into the quality of people’s support systems and how satisfied people are with their obtained guidance. Instead, the IIPSS aims to measure the extent to which people habitually seek out and use the support that is available to them. In addition, contrary to measures of

social support, the IIPSS does not distinguish between different kinds of social support. In fact, the IIPSS most closely resembles the social support dimensions of informational support or guidance. Rather than differentiating between specific kinds of social support, the IIPSS captures more generally whether individuals prefer to solve problems on their own or whether they prefer to consult with others in order to solve their problems.

Collaborative decision-making. Collaborative decision-making addresses people's communication traits. For example, a measure of collaborative processes is the Decision-Making Collaboration Scale (Anderson, Martin, & Infante, 1998). The Decision-Making Collaboration Scale considers people's degree of participation, negotiation skills, and assertiveness when making decisions with other people. An example item is, "often I do not argue my point of view when conflicting views exist." Hence, collaborative decision-making examines the *quality* of people's collaboration efforts. In contrast, the IIPSS does not focus on collaboration styles. Instead, the purpose of the IIPSS is to assess the *extent* to which people are more or less likely to collaborate in order to solve their problems.

Similar to the IIPSS, the dependent style subscale of the General Decision Making Inventory (Scott & Bruce, 1985) assesses people's tendencies to seek assistance from others. Example items for dependent decision-making are, "I rarely make important decisions without consulting other people," and "I often need the assistance of other people when making important decisions." However, while the General Decision Making Inventory is concerned about how individuals make important decisions, the IIPSS is concerned about ordinary problem-solving situations that occur on a daily basis. Hence, the IIPSS captures problem-solving situations more broadly

compared to the General Decision Making Inventory because the IIPSS is not restricted to solving problems of relative significance.

Help-seeking. The IIPSS is similar to but not identical to help-seeking scales such as the Attitude Toward Seeking Professional Psychological Help Scale (Fisher & Turner, 1970). This scale is designed for the special context of counselling (e.g., “If I were experiencing a serious emotional crisis at this point in my life, I would be confident that I could find relief in psychotherapy”). Likewise, the General Help-Seeking Questionnaire (Wilson, Deane, Ciarrochi, & Rickwood, 2005) measures suicidal and non-suicidal help-seeking intentions from formal and informal sources for mental health assessment purposes. Other help-seeking scales have been used in the context of education and in particular in large college classes (e.g., Karabenick, 2003; Karabenick & Knapp, 1991) and high school computer sciences (Cheong, Pajares, & Oberman, 2004). Unlike these scales, the IIPSS is applicable to many different contexts and is therefore not restricted to specific domains.

Everyday problem-solving. Strough, Cheng, and Swenson (2002) constructed a 60-item measure assessing everyday problem-solving preferences in older-aged adults. Strough et al.’s measure distinguishes between domain-general and domain-specific preferences for independent or interdependent problem-solving. Three items describe general preferences for independent problem-solving and three items describe general preferences for interdependent problem-solving. An example item for a domain-general preference for independent problem-solving is “When solving problems in your everyday life, do you prefer to work alone?” An example item for a domain-general preference for interdependent problem-solving is “When solving problems in your everyday life, do you prefer to work with other people?” Fifty-four items describe domain-specific preferences for independent or interdependent problem-solving. The

specific problem-domains concern nine problem-areas relevant to older-aged adults such as memory problems and meal preparation problems. An example item for a domain-specific preference for independent problem-solving is “When solving everyday problems dealing with meal preparation, do you prefer to work alone?” An example item for a domain-specific preference for interdependent problem-solving is “When solving everyday problems dealing with meal preparation, do you prefer to work with other people?”

Similarities and differences between Strough et al.’s (2002) measure and the IIPSS need to be noted. The IIPSS shows considerable overlap with Strough et al.’s items measuring domain-general preferences for independent and interdependent problem-solving. Like Strough et al.’s domain-general preferences for solving everyday problems, the IIPSS assesses general tendencies to solve problems alone or with the help of others. However, the IIPSS is distinct from Strough et al.’s domain-general items in that some of the IIPSS items explicitly contrast independent problem-solving versus interdependent problem-solving (e.g., “I prefer to make decisions on my own, rather than with other people”). Another difference between Strough et al.’s domain-general items and the IIPSS is that the IIPSS presents a wider array of behaviours that describe how independent and interdependent problem-solving occurs in everyday living. For example, all of Strough et al.’s domain-specific items describe independent problem-solving as “prefer to work alone” and interdependent problem-solving as “prefer to work with other people.” In contrast, the IIPSS describes independent problem-solving using different phrasings such as “I would rather struggle through a personal problem by myself” and “it is better to decide yourself.” Likewise, the IIPSS describes interdependent problem-solving using phrasings such as “I prefer to consult with others” and “I like to get advice,” amongst others. Hence, the IIPSS has a broader

perspective on the nature of problem-solving. However, the greatest difference between the IIPSS and Strough et al.'s measure concern Strough et al.'s domain-specific items assessing independence and interdependence in different problem areas. Strough et al.'s nine identified problem domains are particularly relevant to older adults (e.g., memory and medication). In contrast, the IIPSS does not identify specific problem domains. Whereas the identification of variability in independence versus interdependence across specific domains can be of particular interest, identifying problem-domains inevitably restricts the range of applicability (i.e., mainly suitable for older-aged adults). The IIPSS is unique in that it can be applied to a wider range of the population (i.e., from adolescence to old age).

The Need for a New Measure of Independent-Interdependent Problem-Solving

Although numerous scales exist regarding problem-solving and social support, the IIPSS is unique in several respects. First, it focuses on whether or not people tend to seek and use the advice from others in order to solve their problems. Second, it aims at providing a general measure that relates to a wide range of contexts and tasks. Third, it specifically contrasts independent problem-solving from interdependent problem-solving. Therefore, the IIPSS is a valuable addition to related psychometric measures because the IIPSS is suitable to compare general preferences for independence and interdependence across a variety of contexts and samples. This relatively context- and sample unspecific feature distinguishes the IIPSS from other measures of interdependent problem-solving and is thus a valuable addition to the area of everyday problem-solving situations. However, as I explain in the following section, the psychometric properties of the IIPSS have not been sufficiently established to date. Hence, evaluation of the usefulness of the measure also relies on the adequacy of the scale's reliability and validity.

Testing the Reliability and Validity of the IIPSS

Reliability and Structure of the IIPSS

There are two versions of the IIPSS that have been investigated previously (Rubin et al., 2012; Vieira, 2013). The initial version of the IIPSS consisted of 12 items, including six that measured independent problem-solving and six that measured interdependent problem-solving. Seven items were generated by Rubin et al. (2012), four items were taken from similar scales (viz., Triandis et al.'s, 1986, Individualism-Collectivism scale and Singelis', 1994, Self-Construal Scale) and one item was adapted from Oyserman, Coon, and Kemmelmeier (2002). Rubin (2011c) revised the IIPSS in a second version that consisted of 10 items and had more concise instructions. Two items were removed from the original scale. The first deleted item was: "when solving problems, the library and internet often provide more helpful information than family and friends." Rubin et al. (2012) constructed this item to measure independent problem-solving. However, Rubin (2011a) reasoned that information in books and on the internet ultimately come from other people. Hence, this item lacked face validity because it was unclear whether it measured pure independent problem-solving. The second deleted item was: "I can count on my relatives for help if I find myself in any kind of trouble." This item was originally taken from the interdependence subscale of Triandis et al.'s (1986) Individualism-Collectivism scale. Rubin deleted this item because it did not clearly measure a preference for interdependent problem-solving over independent problem-solving. Another modification concerned the scale instructions. Rubin cut down on the explanatory part of the scale instructions to test whether the psychometric properties remained satisfactory without them.

Rubin et al. (2012) and Vieira (2013) reported the internal reliability and factor structure of the IIPSS. Rubin et al. examined Version 1 of the IIPSS on two occasions.

Rubin et al. administered the IIPSS to 312 Australian university students in a pilot examination to examine the appropriateness of the psychometric properties. Reliability testing yielded a single factor structure that explained 33% of the variance (eigenvalue = 3.96). Furthermore, the scale items had good internal consistency ($\alpha = .80$ for the pilot study and $.81$ for the main study).

Vieira examined Version 2 of the IIPSS in a sample comprised of 79 Brazilian business students. In contrast to Rubin et al.'s findings, Vieira's factor analysis yielded a two-factor solution for independent and interdependent problem-solving. The independent problem-solving style factor explained 33% of the variance, and the interdependent problem-solving style factor explained 23% of the variance. Items describing independent and interdependent problem-solving had acceptable internal consistency ($\alpha = .78$ & $.77$, respectively). Critically, other reliability estimates, such as the test-retest reliability of the IIPSS, have not been reported to date.

Validity of the IIPSS

Convergent validity. Rubin et al. (2012) found evidence for the validity of Version 1 of the IIPSS. Rubin et al. coded the IIPSS in a way such that higher scores indicated a preference for independent problem-solving style, and lower scores indicated a preference for interdependent problem-solving style. Supporting the scales' convergent validity, the authors found negative correlations with Cross et al.'s (2000) RISC scale ($r = -.34$) and Goldberg et al.'s (2006) Extraversion scale ($r = -.19$) in the pilot test sample. These results indicated that relational self-concepts and an extraverted trait expression were associated with a greater tendency to solve problems with the help of others.

Although Rubin et al. (2012) demonstrated initial evidence of the convergent validity of the IIPSS, other relevant indications of the measure's convergent validity

have not been established to date. For example, the IIPSS shows a predicted negative association with relational-interdependent self-construal. However, whereas relational-interdependent self-construal captures the notion of interdependent self-views, it does not capture the help-seeking aspect that the IIPSS entails. In the previous section about independent and interdependent forms of problem-solving, I suggested that help-seeking scales such as the General Help-Seeking Questionnaire (Wilson et al., 2005) should be related to the IIPSS. These measures could provide additional support of the convergent validity of the IIPSS in that they assess the degree to which problems are being solved with the help of other people.

Additional measures related to personality traits could also provide further support of the convergent validity of the IIPSS. Rubin et al. found an expected negative relation between the IIPSS and extraversion. However, in addition to extraversion, agreeableness also assesses an orientation to the social world. John and Srivastava (1999) described extraversion as an “*energetic approach* toward the social and material world” (p. 121) and agreeableness as “*prosocial and communal orientation* towards others” (p. 121). As these definitions suggest, in addition to extraversion, agreeableness may be indicative of solving problems with other people because of the strong interpersonal orientation of agreeable individuals. Supporting this assumption, the RISC scale, on which the IIPSS is conceptually based, showed positive relations with both extraversion and agreeableness ($r_s = .28$ & $.35$, respectively; Cross et al., 2000). Therefore, it would support the construct validity of the IIPSS if the measure showed a significant negative correlation with agreeableness (assuming that it is coded such that higher scores indicate a greater preference for independent problem-solving and less of a preference for interdependent problem-solving).

Discriminant validity. There has been no previous investigation examining the discriminant validity of the IIPSS. As Clark and Watson (1995) explained, “a good measure will have a predicted convergent and discriminant correlational pattern (Smith & McCarthy, 1995)” (p. 311). Thus, in addition to the convergent validity, the discriminant validity of the IIPSS needs to be established in order to judge the appropriateness of the measure. Commonly used constructs to determine discriminant validity are demand characteristics and social desirability (King & Bruner, 2000; van de Mortel, 2008; Strohmets, 2008). Demand characteristics, as described by Orne (1962), are specific cues of the experimental situation that raise participants’ awareness of the research aims and, as a consequence, may alter participants’ naturalistic responses. In this way, demand characteristics potentially distort responses to psychometric measurement tools such as the IIPSS. Similarly, it would be beneficial to examine whether participants’ tendencies to respond in socially desirable ways distorted responses to the IIPSS. Social desirability describes the tendency of research participants to convey a favourable image of themselves (see Mortel, 2008; Paulhus, 1984). A scale’s validity is weakened when responses are confounded with socially desirable response patterns (King & Bruner, 2000). Consequently, research disciplines that employ self-report data such as psychology, health sciences, and marketing research have made specific recommendations to control for social desirability (e.g., King & Bruner, 2000; Mortel, 2008).

Other constructs that could provide insight into the divergent validity of the IIPSS are the personality variables of openness, neuroticism, and self-esteem. According to John and Srivastava (1999), neuroticism “contrasts emotional stability and even-temperedness with *negative emotionality*” (p. 121) and openness “describes the breadth, depth, originality, and complexity of an individual’s *mental and experiential*

life” (p. 121). Thus, it appears that neuroticism describes characteristics relating to emotionality and openness describes characteristics relating to cognitive engagement, both of which do not relate to interpersonal trait characteristics. In line with this argumentation, Cross et al. (2000) found that the RISC scale was not significantly associated with neuroticism ($r = .08, p > .05$) and openness to experience ($r = .09, p > .05$).

It would also be important to note whether self-esteem shows divergent validity with the IIPSS. Global self-esteem describes the evaluation of one’s self-worth (Blascovich & Tomaka, 1991). The degree to which self-reliance is important to individuals’ self-esteem appraisals has been found to influence help-seeking behaviours (Addis & Mahalik, 2003; Clegg, Bradley, & Smith, 2006; Karabenick & Knapp, 1991; Tessler & Schwartz, 1972). Karabenick and Knapp (1991) discussed two competing theories that have been put forward to explain the relation between self-esteem and help-seeking. The two theories make opposing predictions regarding the direction of this association. Consistency theory predicts a positive relation between self-esteem and help-seeking, whereas vulnerability theory predicts a negative relation between self-esteem and help-seeking. However, Cross et al. (2000) found no significant relation between global self-esteem and relational-interdependent self-construal. Because the IIPSS is conceptionally related to the RISC scale, it would be reasonable to assume that individuals prefer self-reliance or help-seeking based on their independent or interdependent self-concepts rather than their level of self-esteem. Critically, however, divergent validities between the IIPSS and openness, neuroticism, and self-esteem have not been established to date.

Another important aspect that has not been examined previously is whether the IIPSS is distinct from problem-avoidance. It is possible that interdependent problem-

solvers avoid solving problems by delegating the problem-solving task to other people. Other measures in the area of coping with stressful situations distinguish between independence, interdependence, and escapism (Amirkhan, 1990; Folkman, Lazarus, Gruen, et al., 1986). For example, the revised Ways of Coping scale (Folkman et al., 1986) distinguishes between seeking social support, problem-focused coping, and escape-avoidance. If independent problem-solving style were confounded with the tendency to avoid solving problems, then the underlying construct of preferring to solve problems with the help of other people would not be accurately captured.

Criterion-related validity. In Rubin et al.'s (2012) pilot test, the first version of the IIPSS had good predictive validity (Rubin et al., 2012). The scale was positively related to students' self-reported likelihood to search the internet to solve a university-related problem ($r = .13$) and negatively related to their self-reported likelihood to ask a fellow student to assist them with a university-related problem ($r = -.31$). However, other aspects of criterion-related validity such as the concurrent validity of the IIPSS have not been examined.

A noteworthy aspect of independent-interdependent problem-solving that might contribute to the criterion group validity of the IIPSS is the potential link to individuals' social class backgrounds. Bowman, Kitayama, and Nisbett (2009) argued that lower-class Americans are socialized to be more self-reliant than middle-class Americans because lower-class individuals suffer from social and material deficits compared to middle-class Americans. This would lead lower-class Americans to adopt a form of independence that is characterised by independent decision making and feeling reluctant to turn to others for help. The authors argued that middle-class Americans are socialized to make choices in their more resource-rich environments. As a consequence, middle-class Americans are thought to engage in activities that maintain

large social networks and to seek advice within those networks. Bowman et al. (2009) tested their predictions employing a sample of more than 2,500 Americans who participated in a national telephone interview survey. Consistent with Bowman et al.'s predictions, middle-class Americans reported (a) more social support from friends and (b) a greater preference for giving and receiving advice, as well as (c) more advice giving and receiving behaviours than lower-class individuals. An example item that Bowman et al. used in their measure of advice seeking was "I like to get advice from others before I make a decision," which resembled the interdependent IIPSS item "I prefer to consult with others before making important decisions." Also consistent with Bowman et al.'s predictions, lower-class participants reported being more self-reliant than middle-class participants. An example item in Bowman et al.'s self-reliance measure was "I don't like to ask others for help unless I have to," which resembles the independent IIPSS item "In general, I do not like to ask other people to help me to solve problems." Given the similarity between the concepts of advice receiving and self-reliance as described by Bowman et al. and independent-interdependent problem-solving as measured by the IIPSS, it is possible that lower-class participants will report more independent problem-solving than middle- and upper-class participants.

Another indication for the criterion group validity of the IIPSS could concern gender differences in independent-interdependent problem-solving. Men and women differ in the degree to which they see themselves or others as a supportive resource. Previous research in the area of help-seeking and social support coping has found that women report more social support from family and friends than do men (Day & Livingstone, 2003; Sen, 2004; Zimet, Dahlem, Zimet, & Farley, 1988). In contrast, men report greater self-reliance than women (Addis & Mahalik, 2003; Bowman et al., 2009; Johnson, 1980). These findings indicate that women rely more on other people when

they experience problems, whereas men show a greater tendency to see themselves as a resource in difficult situations.

Gender differences in help-seeking orientations may reflect differences in men and women's self-views. Cross and Madson (1997) reviewed previous research suggesting that women showed more interdependent tendencies compared to men in a wide variety of cognitions and behaviours. Supporting this body of evidence, Cross et al. (2000) presented a summary of eight research studies showing that women consistently reported having greater interdependent self-construal compared to men.

Based on observed gender differences in help-seeking and self-construal, men and women may also differ in their preference for independent-interdependent problem-solving styles. The IIPSS is based on the conceptualisation of relational interdependent self-construal. Rubin (2011c) reasoned that people with greater interdependent self-construal are more likely to be interdependent problem-solvers and people with greater independent self-construal are more likely to be independent problem-solvers. Following this line of thinking, the differences found in previous research concerning men and women's self-construal should influence their preferred problem-solving styles. In particular, because women have a greater interdependent self-construal than men, they may also prefer interdependent problem-solving more than men. Thus, gender differences in independent versus interdependent problem-solving could indicate the concurrent validity of the IIPSS.

In summary, evidence for the reliability and validity of the IIPSS is scarce. The IIPSS was shown to have adequate internal consistency (Rubin et al., 2012; Vieira, 2013). However, investigations of the factor structure of the IIPSS yielded inconsistent results (Rubin et al., 2012; Vieira, 2013). Moreover, while the IIPSS had expected convergent validities with relational-interdependent self-construal and extraversion

(Rubin et al., 2012), other relevant aspects of the scale's validity have not been assessed. A systematic approach for evaluating the psychometric properties of the measure would contribute to the initial results reported in previous literature. In particular, further investigating the underlying factor structure and examining the test-retest reliability of the IIPSS could help establish its reliability. In addition, further examinations of the construct validity and criterion-related validity of the IIPSS could aid in assessing the usefulness of the measure.

Mental Health Implications of Independent and Interdependent Problem-Solving

In the present section, I summarized literature concerning the mental health implications of independent and interdependent problem-solving. Because everyday problem-solving situations occur frequently, emotional consequences of individual differences in problem-solving approaches can have considerable impact on people's negative affect (see Bell & D'Zurilla, 2009; see also Heppner et al., 2004). In the previous chapter, I presented an example in which workaholism (i.e., extreme self-reliance at work) lead to higher levels of anxiety, stress, and burnout syndrome (Bonebright et al., 2000; Burke, 1999; Seybold & Salomone, 1994; Spence & Robbins, 1992). However, interdependent problem-solving has also been shown to indicate negative emotions, particularly when help-seeking lead to unhelpful responses, interpersonal dependencies, or social stigmatisation (Ben-Porath, 2002; Jorm & Wright, 2008; Ko et al., 2005; Link & Phelan, 2006; Rusbult, Johnson, & Morrow, 1986; Wortman & Lehman, 1985; Wortman, Ellard, & Lehman, 1986). Thus, solving problems on an individual or an interpersonal basis can have negative emotional consequences. In the following, I presented previous research identifying under which circumstances independent and interdependent problem-solving was predictive of

negative emotions (e.g., Haaga et al., 1995; Nezu & D’Zurilla, 1989; Kant, D’Zurilla, & Maydeu-Olivares, 1997; Ko et al., 2005; Link & Phelan, 2006).

Independent Problem-Solving and Negative Affect

It has been widely found that poor problem-solving and self-efficacy are related to depression, anxiety, neuroticism, and even suicidality (see Chartrand et al., 1993; Haaga et al., 1995; Heppner et al. 2004; Davila, Hammen, Burge, Paley, & Daley, 1995; Kant et al., 1997; McMurrin et al., 2001; Nezu, 1985, 1986; Nezu & D’Zurilla, 1989). For example, studies have shown that dysfunctional problem-solving, as measured by the Social Problem Solving Inventory (D’Zurilla, & Nezu, 1990), was significantly related to depression and anxiety among students, middle-aged people, and older adults (Haaga et al., 1995; Nezu & D’Zurilla, 1989; Kant et al., 1997). Moreover, dysfunctional problem-solving moderates the relation between everyday problems and negative affect (Kant et al., 1997; Nezu & Ronan, 1988): Everyday problems only led to depression and anxiety when participants felt that they were poor problem-solvers.

Nezu (1986) and McMurrin et al. (2001) demonstrated that the negative emotional effects of poor problem-solving affect state and trait experiences of negative affect. In a sample of 310 American university students, Nezu found that dysfunctional problem-solving and negative life stress significantly predicted state and trait anxiety. He further found that problem-solving moderated the relation between stressful life events and state and trait anxiety. Together, the main effects and the interaction effect of problem-solving and life stress accounted for 24.9% of the total variance in predicting state anxiety scores and 52.2% of the total variance in predicting trait anxiety scores. These results indicated that people’s problem-solving behaviours in the event of stressful life experiences shape current and generalized feelings of anxiety. In addition, McMurrin et al. (2001) showed in a sample of 52 mentally disordered offenders that

dysfunctional problem-solving was positively correlated with neuroticism. These results indicated that the inability to solve problems is associated with the chronic negative affectivity that neuroticism entails.

Similar relations between problem-solving appraisals and negative emotionality were found in the area of personal problem-solving (e.g., Elliott, Herrick, MacNair, & Harkins, 1994; Elliott, Sherwin, Harkins, & Marmarosh, 1995; Watson, Clark, & Tellegen, 1988; see also Heppner et al., 2004). In an American student sample, Elliott et al. (1995) showed that the personal control and problem-solving confidence subscales of the Problem-Solving Inventory (Heppner, 1988) were significant predictors for positive and negative affect, as measured by the Positive and Negative Affect Schedule (Watson et al., 1988). In addition, Elliott et al. found that trait-based negative affect mediated the predictiveness of personal control and problem-solving confidence on negative emotions. Hence, the relation between poor problem-solving appraisals and negative affect can be explained in terms of chronic experiences of psychological distress.

It is important to note that the causality between perceived problem-solving ability and self-efficacy on the one hand, and negative emotionality on the other hand appears to be bidirectional. That is, while poor problem-solving ability and self-efficacy predict negative emotionality due to the emotional strain of inefficient problem-solving attempts (see Nezu, 1987; Nezu & D'Zurilla, 1989; Nezu & Ronan, 1988), the opposite causal direction also holds. Specifically, negative emotions (such as depression and anxiety) have been shown to impair problem-solving endeavours due to interferences of negative emotions in the problem-solving process (Dixon, Heppner, Burnett, Anderson, & Wood, 1993; Nezu & D'Zurilla, 1989; Yen, Rebok, Gallo, Jones, & Tennstedt, 2011). For example, longitudinal research conducted by Dixon et al.

(1993) indicated that deficits in personal problem-solving ability and self-efficacy were a precursor as well as a consequence of negative affect (i.e., depression) among student participants. Thus, individual differences in problem-solving skill, problem-solving confidence, and negative affectivity need to be examined in a way that accounts for the complex relations between these variables (see also Heppner et al., 2004).

In the area of independent versus interdependent coping strategies, Hardie et al. (2006) found no group differences between individuals who prefer to cope with stress on an independent or interdependent basis. Levels of depression, anxiety, and hostility did not significantly differ between independent and interdependent coping strategies. However, individuals who indicated a preference for individual coping strategies reported lower levels of social well-being than individuals who indicated a preference for coping with stress on an interpersonal basis. These findings indicate that the social aspect of interdependence is in itself a source of well-being, albeit one that does not necessarily ameliorate feelings of negative affect. These results are consistent with earlier findings, which demonstrated that social contact and social networks contribute to well-being, *but not to ill-being*, across the life span (e.g., Headey, Holmström, & Wearing, 1984; 1985; Hilleras, Jorm, Herlitz, & Winblad, 1998; McIntyre, Watson, Clark, & Cross, 1991). In this way, variations in independence versus interdependence do not inherently imply harmful versus favourable consequences for negative affectivity. In the following section, I discuss how interdependent problem-solving can contribute to negative emotions.

Interdependent Problem-Solving and Negative Affect

Previous research in the area of social support and interpersonal stress identified numerous ways through which support-seeking negatively impacted on mental health (Lakey, Tardiff, & Drew, 1994; Newsom, Rook, Nishishiba, Sorkin, & Mahan, 2005;

Shinn, Lehman, & Wong, 1984; Thoits, 1995). For example, social demands and inappropriate responses from support-givers have been found to increase feelings of stress in those who sought help (Clark & Stephens, 1996; Coyne & Downey, 1991; Rook, 1992; Ross & Mirowsky, 1989; Shinn et al., 1984; Lehman & Wortman, 1986; Wortman & Lehman, 1985). Qualitative interviews gave a detailed account of distressing help-seeking attempts (Lehman & Wortman, 1986; Wortman & Lehman, 1985). In particular, individuals who sought help from their relatives often felt that their family members were pressuring them to come to a resolution, or that family members falsely stated that they understood the problem (Lehman & Wortman, 1986; Wortman & Lehman, 1985). Support recipients described these kinds of responses to be inappropriate and unhelpful (Lehman & Wortman, 1986; Wortman & Lehman, 1985). To account for negative effects of social support, Shinn et al. (1984) proposed that negative experiences regarding support-seeking should be recognized as an additional source of stress among individuals who experienced problematic life situations. Other researchers have also recognized the relatively strong influence of conflictual social exchanges over supportive social exchanges on psychological well-being (see Finch, Okun, Pool, & Ruehlman, 1999; Rook, 1998; Schuster, Kessler, & Aseltine, 1990). Overall, findings on harmful effects of social support indicated that support-seeking contributed to feelings of negative affect when the needs and wants of the support-seeker were not met by others.

Perhaps the most obvious form of interdependent problem-solving occurs when an individual is mentally or physically impaired and has little choice but to rely on others to solve everyday problems. In these instances, caregivers' dysfunctional problem-solving patterns can contribute to the distress experienced by those who depend on them (Keitel, Zevon, Rounds, Petrelli, & Karakousis, 1990; Ko et al., 2005;

Merz et al. 2011). For example, Ko et al. (2005) investigated problem-solving abilities of women who were the primary caregivers of their spouses with prostate cancer. Ko et al. found that women's dysfunctional problem-solving (i.e., negative problem orientation, impulsivity/ carelessness style, and avoidance style) significantly predicted the level of distress experienced by their spouses. The authors further found that the distress felt by caregiving women mediated this relation. Interestingly, functional problem-solving (i.e., rational problem-solving and positive problem orientation) did not predict spouses' levels of distress. These findings indicate that people who rely on interdependent problem-solving can experience higher levels of emotional distress if the people they turn to for help are poor problem-solvers and experience distressing emotions themselves.

Similar patterns of the relation between interdependence and psychological distress have been found in dating couples. The interdependent nature of romantic relationships can facilitate emotional vulnerability if one or both partners solve relationship problems poorly (Kelley & Thibaut, 1978; Metts & Cupach, 1990; Rusbult et al., 1986). For example, Rusbult et al. (1986) showed that destructive relationship problem-solving approaches (i.e., exit and neglect) predicted greater levels of partner distress compared to constructive problem-solving approaches (i.e., voicing problems and loyalty) among university student couples. In addition, inadequate ways of responding to one's partners' destructive problem-solving approaches predicted further increases in emotional distress. Hence, interdependent problem-solving in relationships can accentuate negative emotional effects of poor problem-solving behaviours.

Seeking help for solving mental health problems can lead to stigmatisation, which intensifies feelings of stress (Barney, Griffiths, Jorm, & Christensen, 2006; Ben-Porath, 2002; Eisenberg, Downs, Golberstein, & Zivin, 2009; Jorm & Wright, 2008;

Leong & Zachar, 1999; Link & Phelan, 2006). Broadly speaking, stigma refers to negative evaluations of oneself (i.e., self-stigmatisation) or other people (i.e., stigmatisation of others) relative to societal norms (for a more thorough conceptualisation, see Link & Phelan, 2001). Ben and Porath (2002) showed that (a) the type of problem (mental health versus physical health) and (b) the way of dealing with that problem (on an independent versus interdependent basis) interacted to predict the severity of stigmatisation. In particular, university students labelled depressed people who sought professional help as being less emotionally stable, less interesting, and less confident than depressed people who did not seek help. In support of these findings, Jorm and Wright (2008) found in telephone interviews that individuals who sought help for solving psychological problems were more likely to be stigmatised by peers than individuals who did not seek help. The feelings of stress associated with such stigmatisation have been shown to intensify negative mental health outcomes (see Link & Phelan, 2006). Indeed, the prospect of seeking social support for mental health problems can evoke fear of stigmatisation to the point to which individuals choose to refrain from seeking help altogether (Addis & Mahalis, 2003; Corrigan, 2004; Pederson & Vogel, 2007).

In summary, I presented previous literature describing different processes under which independent and interdependent problem-solving lead to negative emotions (e.g., Hardie et al., 2006; Ko et al., 2005; Link & Phelan, 2006; McMurrin et al., 2001). The reviewed literature I presented in this section suggests that neither preference for independent nor interdependent problem-solving per se determines negative emotional outcomes. Supporting this assumption, Hardie et al. (2006) found no significant differences in levels of anxiety, depression, and hostility among individuals who preferred independent coping approaches and individuals who preferred interdependent

coping approaches. However, literature in the area of personal problem-solving ability suggests that dysfunctional problem-solving is a significant contributor to every-day experiences of negative affect (e.g., Chartrand, Rose, Elliott, Marmarosh, & Caldwell, 1993; Haaga et al., 1995; Heppner et al. 2004; Nezu & D’Zurilla, 1989). In addition, while interdependent problem-solving has been identified to correlate with positive emotions (e.g., Headey et al., 1984; 1985; Hilleras et al., 1998; McIntyre et al., 1991), there are a number of instances in which interdependent problem-solving can have negative consequences for emotional health (Ben-Porath, 2002; Jorm & Wright, 2008; Ko et al., 2005; Link & Phelan, 2006; Rusbult et al., 1986). Thus, both independent and interdependent problem-solving can contribute to negative emotional outcomes under certain circumstances.

In the following section, I presented a potential moderator of the relation between problem-solving style and negative affect. Openness to experience is a personality trait that is related to cognitive ability, positive problem-solving approaches, and self-efficacy (e.g., Bouchard, 2003; DeYoung, Quilty, Peterson, & Gray, 2014; Kaufman, 2013; Kaufman et al., 2010; Nauta, 2004). Openness may constitute a way through which to differentiate when an independent or an interdependent problem-solving style leads to more negative emotional outcomes. In particular, it is possible that an intrapersonal match between problem-solving style, as represented by the IIPSS, and personal problem-solving appraisals, as represented by openness, helps determine when an independent or interdependent problem-solving style leads to more negative emotional outcomes. In the following section, I presented findings demonstrating the relation between openness to experience and personal problem-solving appraisals in greater detail.

The Moderating Role of Openness to Experience in Personal Problem-Solving Situations

The Big Five personality dimension of openness to experience has been linked to several cognitive problem-solving processes that indicate adaptive problem-solving appraisals and behaviours (e.g., Bouchard, 2003; DeYoung, 2014; Judge & Ilies, 2002; Kaufman, 2013; McMurrin et al., 2001). Thus, openness may relieve negative emotions in stressful situations when problems are dealt with on an individual basis. In the current section, I presented literature demonstrating that openness was related to functional problem-solving approaches and self-efficacy (e.g., Bouchard, 2003; Judge & Ilies, 2002; McMurrin et al., 2001). I concluded this section by arguing that there has been no previous investigation examining how openness may influence the emotional consequences of independent versus interdependent problem-solving styles.

Relation between Openness and Effective Personal Problem-Solving

Many of the items in the BFI openness subscale refer to people's ability to generate new, inventive, and ingenious ideas independently from others. Items that illustrate the idea-generating aspects of the BFI openness subscales are: "I see myself as someone who is original, comes up with new ideas," "I see myself as someone who is ingenious, a deep thinker," "I see myself as someone who has an active imagination," "I see myself as someone who is inventive," and "I see myself as someone who likes to reflect, play with ideas." John and Srivastava (1999) found that items relating to openness to ideas, imagination, and aesthetics loaded highest on the openness factor across three common Big Five measures, namely the Big Five Inventory (John & Srivastava, 1999), the NEO Five Factor Inventory (Costa & McCrae, 1992), and the Trait Descriptive Adjectives (Goldberg, 1992). This indicates that openness to ideas is among the three key aspects of the openness to experience facet. Supporting this

observation, personality reviews summarized that openness is related to intellect, creativity, and need for cognition (e.g., Goldberg, 1990; McCrae, 1996; McCrae & Sutin, 2009).

Openness is the main trait among the Big Five that subsumes aspects of cognitive engagement. In his recent review on the openness dimension, DeYoung (2014) described openness as “the tendency to explore cognitively and pursue information” (p. 380). This definition suggests a strong cognitive component of openness that integrates with a content analysis of several Big Five measures (Zillig, Hemenover, & Dienstbier, 2002). Zillig et al. (2002) found that openness had the strongest cognitive component among the Big Five traits across measures.

Empirical research supported the association between openness and cognitive ability (DeYoung et al., 2014; Kaufman, 2013; Kaufman et al., 2010). For example, Kaufman et al. (2010) examined the relation between openness, implicit learning ability, and major aspects of cognitive ability (i.e., verbal, perceptual, & mental rotation) in a sample of 153 16-18 year old British college students. The authors found that openness was significantly and positively related to implicit learning ($r = .29$), verbal reasoning ($r = .29$), figural speed ($r = .22$), working memory ($r = .19$), and intellect ($r = .19$). DeYoung et al. (2014) investigated the relation between openness, intellect, and cognitive ability in an American student sample ($N = 125$) and a community sample consisting of 191 male volunteers. The authors found that openness predicted verbal intelligence in both samples even after controlling for intellect. DeYoung et al. assumed that openness independently predicted verbal intelligence because of the positive association between openness and implicit learning described by Kaufman et al. (2010). According to DeYoung et al., implicit learning describes the unconscious detection of patterns in one’s environment, which might contribute to other cognitive

activities such as verbal abilities, independent of a person's intellect. In another study, Kaufman (2013) sought to clarify the relation between the Big Five personality traits and creative achievement among 146 British arts and science students. He found that only the personality trait of openness was positively and significantly related to measures of explicit cognitive ability. Cognitive abilities such as cognitive complexity and flexibility have been shown to help problem-solving because of an increased variety in considered alternatives (Stewin & Anderson, 1974, as seen in Jonassen, 2000). Chi and Glaser (1985) emphasized the importance of cognitive ability for solving problems: "Solving problems is a complex cognitive skill that characterizes one of the most intelligent human activities" (p. 227). Further demonstrating that openness is related to cognitive engagement in problem-solving situations, McCrae and Costa (1986) found that openness was related to a greater likelihood to think about a problem from different perspectives. McCrae and Costa also observed that openness was related to a greater readiness to seek additional information and to apply novel strategies to find solutions to problems.

Supporting the idea that openness is related to functional problem-solving, McMurrin et al. (2001) and Bouchard (2003) found that openness was related to adaptive problem-solving approaches. In particular, McMurrin et al. found that openness was positively related to rational problem-solving, even after controlling for neuroticism. In addition, Bouchard (2003) found that openness was associated with planful problem-solving among married couples who were asked about their relationship problems. As Bouchard pointed out, "in order to engage oneself in planful problem-solving, one has to be willing to try new approaches and think about the problem from different perspectives. We have seen that this is facilitated by a high level of openness" (p. 10).

In the area of organizational work settings, openness was found to relate to constructive problem-solving in supervisors and managers. Moberg (2001) presented a study in which he linked the Big Five personality traits to conflict strategies in a sample of 249 American business supervisors and managers. Moberg found that openness was positively associated with addressing problems openly and making compromises in conflict situations. He argued that supervisors and managers high in openness to experience “prefer strategies that express flexibility, adaptability, generation of new solution alternatives, and consideration of the opponent’s view” (p. 50). These features of conflict resolution in people with high levels of openness resemble the effective problem-solving process described by D’Zurilla and Goldfried (1971) in the area of social problem-solving. D’Zurilla and Goldfried defined effective problem-solving as the process of identifying potentially successful responses and making the most successful response alternative the most likely one to be exerted.

In summary, previous research indicates that openness to experience is related to cognitive exploration and positive problem-solving behaviours (Bouchard, 2003; DeYoung, 2014; DeYoung et al., 2014; McMurrin et al., 2001; Moberg, 2001; Kaufman, 2013; Kaufman et al., 2010). In this way, openness may also facilitate personal feelings of problem-solving competence and self-efficacy. I presented the relation between openness and self-efficacy in problem-solving situations in the following section.

Relation between Openness and Problem-Solving Self-Efficacy

In line with findings regarding a positive relation between openness and functional problem-solving approaches, openness has also been associated with perceived self-efficacy to solve problems (Judge & Ilies, 2002). Self-efficacy is defined as “people’s beliefs in their capabilities to produce desired effects by their own actions”

(Bandura, 1997, p. vii). Previous research indicated that self-efficacy appraisals were positively associated with optimism and competence (e.g., Schwarzer, Bäßler, Kwiatek, Schröder, & Zhang, 1996), and negatively associated with depression, anxiety, helplessness, and disruptive problem-solving behaviours (Bandura, 1997; Maddux & Meier, 1995; Williams, 1995). Judge and Ilies (2002) found in their meta-analytical review on personality and the motivational factors of goal setting, expectancy, and self-efficacy that openness had small but consistent positive correlations with self-efficacy across studies. An explanation for this finding may be found in the area of effort-based learning. In Mayer's (1998) effort-based learning approach, individuals are thought to elaborate on a problem more deeply when they believe that they are proficient in solving the problem at hand. Hence, confidence in the ability to solve problems is assumed to facilitate the problem-solving process through increased efforts to find a solution.

Similar to self-efficacy appraisals, Penley and Tomaka (2002) demonstrated that openness was associated with a number of constructive personal problem-solving appraisals during and after a stressful task. Specifically, student participants who prepared and gave a speech to an audience were asked about their problem-solving appraisals, coping strategies, and post-task appraisals. Openness was positively related to participants' perceived coping ability, perceived responsibility for and control over the task, and reports of active coping approaches (e.g., problem-focused coping). Conversely, openness was negatively related to participants' perceived task demand, perceived stress, fear, and shame, and reports of passive endurance coping. Thus, openness was associated with students' perceived abilities to master a potentially stressful task on their own.

In the area of career choice, studies have shown that openness was a predictor of career self-efficacy (Hartman & Betz, 2007; Nauta, 2004; Rottinghaus et al., 2002). For example, Nauta (2004) investigated the relations between the Big Five personality traits and vocational self-efficacy. Areas of self-efficacy were examined according to the occupational domains described by Holland (1997): realistic, investigative, artistic, social, enterprising, and conventional. In a sample of 147 American college students, Nauta found that openness was significantly and positively correlated with participants' self-efficacy in all six occupational domains (r s ranged from .18 for conventional to .48 for artistic). These results were consistent with previous findings by Rottinghaus et al. (2002). In a later study, however, Hartman and Betz (2007) did not replicate the association between openness and each of Holland's career self-efficacy domains. In a sample consisting of 301 American university students, the authors found that openness was significantly correlated with realistic, investigative, artistic, and social self-efficacy (r s ranged from .17 for social to .47 for artistic self-efficacy) but not with enterprising and conventional self-efficacy. Hartman and Betz further measured participants' confidence in expanded occupational skills such as office services and creative production. Openness was found to show significant positive correlations with confidence in helping, science, creative production, writing, and cultural sensitivity (r s ranged from .21 for helping to .40 for cultural sensitivity). These results demonstrated that openness was related to a variety of self-efficacy appraisals in the workplace.

In summary, openness to experience is a personality trait that describes individuals' levels of cognitive engagement and cognitive skills, which are thought to facilitate the problem-solving process (Chi & Glaser, 1985; DeYoung, 2014; DeYoung et al., 2014; Kaufman, 2013; Kaufman et al., 2010; Zillig et al., 2002). In addition, openness has been found to correlate positively with constructive problem-solving

behaviours and appraisals of self-efficacy (Bouchard, 2003; Hartman & Betz, 2007; McMurrin et al., 2001; Moberg, 2001; Nauta, 2004; Penley & Tomaka, 2002; Rottinghaus et al., 2002). Thus, there is some indication in previous literature suggesting that openness to experience constitutes a personal resource to approach problems in beneficial ways. I assumed that this personal characteristic could influence the degree to which an independent versus an interdependent problem-solving style predicts negative emotions.

Summary

In this section, I have summarized literature showing that (a) independent and interdependent problem-solving can lead to negative emotions, and that (b) openness is a cognitive trait that is related to the selection of beneficial problem-solving behaviours and to positive appraisals of one's own problem-skills. Openness may be a contributing factor in determining whether independent or interdependent problem-solving leads to greater emotional distress. However, I could not find any literature that investigated whether problem-solving style and openness interacted to predict negative emotions. This presents a gap in the literature on problem-solving and negative emotionality. It is important to address this gap because an understanding of the interplay between independence-interdependence and openness could help identify the conditions under which negative emotional effects can be expected in habitually self-reliant and habitually help-seeking problem-solvers.

In the following chapter, I present my first investigation in which I addressed some of the gaps that arose from this literature review. Relating to the psychometric properties of the IIPSS, I investigated whether Version 2 of the IIPSS showed adequate internal consistency and whether the IIPSS showed a one- or two-factor structure. I also investigated whether the IIPSS showed convergent validities with agreeableness and

extraversion, and divergent validities with openness, neuroticism, and self-esteem. I further examined whether the IIPSS was related to gender and social class. Relating to the influence of problem-solving style on negative emotionality, I explored whether openness to experience and problem-solving style interacted to predict neuroticism. In particular, I assessed whether openness helped determine when a preference for independent versus interdependent problem-solving lead to greater trait-based negative affect.

Chapter Three: Study 1. The Moderating Effect of Openness on the Relation between Independent Problem-Solving and Neuroticism

Introduction

Initial Empirical Investigation

I conducted the first study to investigate aspects that relate to both of my research aims. My first aim was to examine the reliability and validity of the second version of the IIPSS instrument. My second research aim was to examine the moderating effect of openness to experience on the relation between independent-interdependent problem-solving and neuroticism. Please refer back to Chapter 1 for an explanation of the changes made regarding my second research aim. In the following, I introduced relevant previous research, which I presented separately for each research aim.

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure of the IIPSS. I expected a single factor structure of the revised IIPSS for conceptual reasons. Rubin et al. (2012) designed the IIPSS to assess “individual differences in the tendency to work on one’s own or seek help from others to solve problems and achieve goals” (p. 7). Hence, the purpose of the scale is to detect the relative preference for independent or interdependent problem-solving. In a unidimensional model, independent and interdependent problem-solving are conceptualized as opposite poles of a single underlying dimension. Therefore, a single bipolar dimension allows contrasting the two types of problem-solving against one another, which is in line with the purpose of the IIPSS. However, it needs to be noted that even though the IIPSS measures “general” preferences for problem-solving styles, each act of solving problems occurs in specific problem-solving situations such as

dealing with technical problems, housing problems, and so forth. It is therefore possible that individuals prefer independent and interdependent problem-solving depending on the nature of the problem, which implies that the underlying factor structure of the IIPSS might be two-dimensional.

In a two-dimensional model, independent and interdependent problem-solving are regarded as two independent dimensions. This implies that individuals can score high or low on both dimensions at the same time. This notion has two important implications. First, people scoring *low* on both dimensions would be described as people who do not prefer to solve problems at all (either independently or interdependently). In that way, a two-dimensional model would measure the *amount* of different types of problem-solving rather than the *preference* for one type of problem-solving over the other that the IIPSS intends to measure. Second, in a two-dimensional model, individuals can also score *high* on both dimensions at the same time. People scoring *high* on both dimensions would prefer to solve problems *both* on their own *and* with the help of other people. It is possible that individuals use both problem-solving styles depending on the specific problem-solving situation. For example, a person might prefer to solve problems regarding their career path on their own, but prefer to consult with others when solving problems regarding financial investment options. It is also possible that some individuals start approaching problems by gathering as much advice as possible from other people (i.e., interdependent problem-solving), but then decide on the best solution to the problem on their own (i.e., independent problem-solving).

Empirical evidence for the underlying factor structure of the IIPSS yielded mixed results (Rubin et al., 2012; Vieira; 2013). An investigation of the first version of the IIPSS in an Australian immigrant population ($N = 137$) supported the conceptual

considerations of a single factor structure (Rubin et al., 2012). Vieira (2013) employed the second version of the IIPSS in his research on need for touch and problem-solving style in the area of consumer psychology. As explained in the previous chapter, Vieira found a two-factor solution for the IIPSS. The sample size ($N = 79$) employed to conduct this factor analysis did not meet the recommendations made by a number of methodologists (Comrey & Lee, 1992; Gorsuch, 1983; Guadagnoli & Velicer 1988; Guilford, 1954; Hatcher & Stepanski, 1994; Hutcheson & Sofroniou, 1999; Kline 1994; Russell, 2002). Generally, researchers are advised to employ sample sizes of at least 100 cases for factor analyses (for a review of factor analyses in social and personality psychology, see Russell, 2002). Although the minimum sample size used also depends on other aspects of the research design such as communality of the variables (see Preacher & MacCallum, 2002), Costello and Osborne (2005) endorsed the advantages of a large sample size in factor analysis. The authors reviewed 1,700 studies indexed on the PsycINFO database that employed some form of exploratory factor analyses.

Costello and Osborne concluded:

Our analyses demonstrate that at a 20:1 subject to item ratio there are error rates well above the field standard $\alpha = .05$ level. The most replicable results are obtained by using large samples (unless you have unusually strong data). (pp. 7-8)

Even at a 20:1 subject to item ratio, the sample size for the 10-item IIPSS measure would constitute of 200 participants. I intend to use a sample size that well exceeds 200 participants ($N = 400$) in order to obtain reliable results for a factor analysis on the IIPSS data. I assume that factor analytical testing will result in a single factor solution for Version 2 of the IIPSS because a single factor structure contrasts independent from

interdependent problem-solving style, which aligns more closely with the general conceptualization of the IIPSS than a two-factor structure (Rubin et al., 2012).

Relation between problem-solving style and personality traits. An important aspect of convergent validity relates to agreeableness and extraversion. Like agreeableness and extraversion, relational interdependent self-construal shows an orientation towards the social world. Therefore, it is reasonable to suggest that individuals with greater interdependent self-construal will be more extraverted and agreeable than individuals with greater independent self-construal. Previous research supports this reasoning. Cross et al. (2000) found that their RISC scale showed moderate correlations with agreeableness ($r = .35$) and extraversion ($r = .28$). In addition, Rubin et al. (2012) found that Version 1 of the IIPSS showed a weak to moderate negative correlation with extraversion ($r = -.19$). Consequently, I assume that a preference for interdependent problem-solving is associated with higher extraversion and agreeableness because of the social nature conveyed in interdependent problem-solving, agreeableness, and extraversion. Based on Rubin et al.'s finding concerning the relation between Version 1 of the IIPSS and extraversion, I predict weak to moderate negative associations between problem-solving style and agreeableness and extraversion.

I expected that openness to experience and neuroticism would show divergent validities with problem-solving style. As explained in the previous chapter, openness describes characteristics relating to cognitive engagement. Unlike agreeableness and extraversion, the openness trait does not relate to interpersonal trait characteristics, and should thus not be related to measures of interdependence. In line with this argumentation, the RISC scale was not significantly associated with openness to experience ($r = .09$). In addition, Blanchard-Fields and Camp (1990) found that

individuals' levels of openness did not predict the degree to which adolescents, middle-aged, and elderly adults solved their problems on an interpersonal basis. Hence, I predicted that the IIPSS would not correlate significantly with openness to experience. In addition to openness, Cross et al. (2000) predicted that relational-interdependent self-construal was unrelated to the emotional trait of neuroticism. In line with their expectations, the RISC scale showed no significant correlations with neuroticism ($r = .08$). Therefore, problem-solving style may also be unrelated to neuroticism. Following related findings (Blanchard-Fields & Camp, 1990; Cross et al., 2000), I predict very weak relations (i.e., correlation coefficients between .10 or $-.10$) between problem-solving style and openness and neuroticism.

I further expected that conscientiousness would show divergent validity with problem-solving style. Cross et al. (2000) made no predictions regarding the relation between relational-interdependent self-construal and conscientiousness. However, Watson and Hubbard (2006) investigated personality traits and individual differences in problem-solving styles, which were measured by the dispositional version of the COPE inventory (Carver, Scheier, & Weintraub, 1989). The authors found that conscientiousness was unrelated to instrumental social support-seeking ($r = .03$). Arguably, interdependent problem-solving is similar to instrumental support-seeking in that both constructs relate to task-oriented problem-solving with the help of other people. For example, an IIPSS-item for interdependent problem-solving is "I prefer to consult with others before making important decisions." Similarly, an example item for instrumental support-seeking is "I try to get advice from someone about what to do." Watson and Hubbard's findings showed that this dimension was not related to conscientiousness. Therefore, given the similarity between instrumental support-seeking and interdependent problem-solving, it is possible that problem-solving style

would show only very weak correlations with conscientiousness (i.e., the correlation coefficient does not exceed .10 or $-.10$).

Summary. One aim of the current study was to further establish the psychometric properties of the IIPSS. In particular, I tested whether Version 2 of the IIPSS would have a one- or two-factor structure. Following Rubin et al. (2012), I predicted that it would have a one-factor structure. I also aimed to provide further evidence for the reliability and validity of Version 2 of the IIPSS. Specifically, I expected that the IIPSS would be weakly to moderately and negatively correlated with the social personality traits of extraversion and agreeableness, but would show only very weak correlations with openness, neuroticism, and conscientiousness.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

I openly acknowledged in Chapter 1 that the second research aim was modified after the results to Studies 1 – 4 were known. Note that I proceeded by pointing out key themes that relate to the modified research aim because those key themes appeared to be the most theoretically relevant. Generally, the IIPSS measures one's propensity to engage in independent or interdependent problem-solving but it does not measure one's appraisal to successfully carry out that problem-solving style. In the current research, I considered the possibility that openness provides an index of positive problem-solving approaches and problem-solving self-efficacy. It is further possible that a positive approach to solving problems may interact with the preference to solve problems independently and predict negative emotions. In the previous chapter, I presented research findings demonstrating that independent and interdependent problem-solving can lead to negative emotional outcomes (e.g., Burger, 1989; Hilleras et al., 1998; Jorm & Wright, 2008; Ko et al., 2005; McMurrin et al., 2001; Nezu, 1986). I also presented

findings suggesting that openness relates to functional problem-solving approaches and self-efficacy (e.g., Bouchard, 2003; DeYoung, 2014; Hartman & Betz, 2007; Kant et al., 1997; Nauta, 2004). In my first experimental investigation, I explore whether individual differences in openness and independent-interdependent problem-solving may account for differential adaptation patterns. In the following, I briefly revisit relevant literature presented in Chapter 2 and recapitulate my research rationale.

Poor problem-solving approaches and negative emotionality. Poor individual problem-solving has been found to increase current and generalized experiences of negative emotions (e.g., Davila, Hammen, Burge, Paley, & Daley, 1995; Kant, D’Zurilla, & Maydeu-Olivares, 1997; McMurrin, Egan, Blair, & Richardson, 2001; Nezu, 1985, 1986). For example, social problem-solving, as measured with the revised Social Problem-Solving Inventory (D’Zurilla, Nezu & Maydeu-Olivares, 2000), distinguishes between people’s functional and dysfunctional personal problem-solving orientations and problem-solving approaches in social situations. McMurrin et al. (2001) tested how social problem-solving was related to the Big Five personality traits among 52 adult patients in a psychiatric unit in the UK. Their study showed that positive problem-solving orientation, rational problem-solving, and the total social problem-solving score were negatively correlated with neuroticism. In addition, negative problem orientation, impulsive/careless style, and avoidance style showed significant positive correlations with neuroticism. Thus, all functional problem-solving styles were negatively associated with negative emotionality and all dysfunctional problem-solving styles were positively associated with negative emotionality. As the authors pointed out, the personality patterns of mentally disordered populations as compared to healthy populations seem to differ in terms of severity rather than in a qualitative way. Confirming this claim, a review on the mental health implications of

social problem-solving reported that dysfunctional problem-solving approaches led to greater levels of long-term psychological distress in student, adult, and clinical samples, even when current levels of stress were accounted for (see Nezu et al., 2004).

Nezu (1986) found that personal problem-solving appraisals moderated the effect of stressful life events on anxiety in a student population. Problem-solving was measured by the Problem Solving Inventory (Heppner & Peterson, 1982), which assessed problem-solving confidence, approach-avoidance style, and personal control. Life stress was measured by the Life Experiences Survey (Sarason et al., 1978) and anxiety was measured by the State-Trait Anxiety Inventory (Spielberger, Gorsuch, & Luschene, 1970). In a sample of 310 American university students, Nezu found that negative problem-solving appraisals and negative life stress significantly predicted state and trait anxiety. Moreover, problem-solving moderated the relation between stressful life events and anxiety. The results indicated that problem-solving and stressful life experiences accounted for current feelings of anxiety (24.9% of the total variance) and generalized feelings of anxiety (52.2% of the total variance).

Help-seeking difficulties and negative emotionality. Interdependent problem-solving approaches have been found to negatively affect mental health when help-seeking attempts caused distressing experiences (e.g., Lakey et al., 1994; Newsom et al., 2005; Shinn et al., 1984; Thoits, 1995). Help-seeking is an inherently social activity, and thus involves social demands (see Karabenick, 2004). These social demands and inadequate responses of the support-givers can be sources of distress in help-seeking situations (e.g., Clark & Stephens, 1996; Ko et al., 2005; Lehman & Wortman, 1986; Rook, 1992). As Lennon (1972) stated, “support and stressors often reside in the same set of interactions and cannot be understood apart from this relational context” (p. 262). In this way, individuals who rely on others to help them solve their problems may

experience long-term negative emotional effects if their support givers engage in dysfunctional problem-solving behaviours. For example, Ko et al. (2005) found that interdependent spouses who suffered from prostate cancer showed increased rates of distress when their caregiving wives engaged in dysfunctional problem-solving approaches such as negative problem orientation and impulsive actions. Reviews on the relative emotional impact of positive and negative support-seeking experiences suggested that conflictual exchanges were equally or more consequential than positive exchanges, and that both positive and negative support-seeking experiences made unique contributions to predicting negative emotionality (see Finch et al., 1999; Rook, 1998; Schuster et al., 1990). Thus, studies in the areas of help-seeking, interdependence, and social support suggested that seeking interpersonal support in problematic situations can lead to substantial emotional strain if the social exchange is in itself a source of distress.

Openness and personal problem-solving appraisals. As explained in the previous chapter, openness is the main trait among the Big Five that subsumes aspects of cognitive engagement (DeYoung, 2014; Zillig et al., 2002). In line with these content analyses, openness has been found to relate to cognitive complexity, flexibility, and functional problem-solving (Bouchard, 2003; DeYoung et al., 2014; Kaufman, 2013; Kaufman et al., 2010; Moberg, 2001). For example, Bouchard (2003) examined how married couples addressed relationship problems. In a sample of 200 French-Canadian couples, Bouchard measured couples' openness levels and the degree to which they engaged in planful problem-solving, also referred to as problem-focused coping (Folkman & Lazarus, 1988). The author observed significant weak-to-moderate correlations between openness and planful problem-solving ($r = .21$). As Bouchard pointed out, "in order to engage oneself in planful problem-solving, one has to be

willing to try new approaches and think about the problem from different perspectives. We have seen that this is facilitated by a high level of openness” (p. 10).

Openness has also been associated with individuals’ self-efficacy to solve problems (e.g., Hartman & Betz, 2007; Judge & Ilies, 2002; Nauta, 2004; Rottinghaus et al., 2002). For example, Hartman and Betz (2007) and Nauta (2004) investigated the relations between the Big Five personality traits and vocational self-efficacy in the area of occupational psychology. The authors found that openness showed weak-to-moderate and moderate associations with vocational self-efficacy appraisals, especially in realistic, investigative, artistic, and social work domains. A meta-analysis on personality and performance motivation suggested that openness showed weak but consistent positive associations with self-efficacy across studies (Judge & Ilies, 2002). These results indicated that individuals who are high in openness believe that they have the capacity to solve tasks in a self-sufficient manner.

Research rationale. On an exploratory basis, I sought out to find how the problem-solving process would vary along the dimensions of openness to experience, independent-interdependent problem-solving, and neuroticism. Specifically, previous findings indicate that both independent and interdependent problem-solving approaches can lead to negative emotional patterns under certain circumstances. That is, independent problem-solving predicted negative emotionality when personal problem-solving approaches were poor, and interdependent problem-solving predicted negative emotionality when individuals experienced social conflicts as a result of seeking help (e.g., McMurrin et al., 2001; Nezu, 1986; Ko et al., 2005; Lakey et al., 1994). In the current research, I explored a novel condition that could help determine when an independent versus an interdependent problem-solving style would predict greater negative emotional patterns. In particular, I investigated whether the personality trait of

openness interacted with individuals' problem-solving styles to predict negative emotions. I assumed that openness could modulate whether an independent or interdependent problem-solving style predicted greater negative emotional outcomes because openness has been shown in previous literature to relate to constructive individual problem-solving approaches such as cognitive engagement, planful problem-solving, and self-efficacy appraisals (e.g., Bouchard, 2003; DeYoung et al., 2014; Hartman & Betz, 2007; Nauta, 2004). In this way, openness has been shown to relate to a positive problem-solving orientation similar to functional problem-solving approaches discussed in the areas of personal and social problem-solving, which have been shown to relieve negative emotions in independent problem-solvers (see Bell & D'Zurilla, 2009; see also Heppner et al., 2004). Therefore, openness may constitute an intrapersonal variable that interacts with independent versus interdependent problem-solving preferences to predict negative emotions (e.g., neuroticism). No prior research was known to me that investigated this particular relation. In this respect, the present research was unique and attempted to fill a gap in the current psychology literature.

Overview of Study 1

The current research project had two aims: (a) to investigate the psychometric properties of the IIPSS, and (b) to investigate the relation between personality and independent-interdependent problem-solving style. Undergraduate psychology students completed a battery of psychometric scales that assessed personality, independent-interdependent problem-solving, and demographic variables such as gender and social class. Regarding the psychometric properties of the IIPSS, I hypothesised that the IIPSS has a single factor structure and shows good internal reliability. In regards to the construct validity, I expected that the IIPSS has weak to moderate negative correlations with extraversion and agreeableness but very weak and nonsignificant correlations with

neuroticism and openness. I investigated the relation between the IIPSS, openness, and neuroticism on an exploratory basis.

Method

Participants

Participants were 408 first year students enrolled in a psychology undergraduate course at an Australian university. Participants included 312 women and 96 men whose mean age was 21.56 ($SD = 5.59$) and who ranged from 17 to 53 years. Out of the 408 participants, 348 were Caucasian, 16 were Asian, 10 were Aboriginal, and 2 were African. Ten participants indicated that they held ethnicities other than the ones mentioned and five participants declined to indicate their ethnicity. All participants were recruited through the School of Psychology's Sona Research Participation System and were awarded 1% course credit point for taking part in this study.

One participant declined their informed consent and was consequently excluded from analyses. Two participants were excluded on the basis of very low variability in their response patterns. One of these participants exclusively gave the response *neutral* and finished the study within five minutes. The other participant only gave extreme responses (either *strongly disagree* or *strongly agree*) throughout the study.

Participants answered to a single-item measure on truthful responding, which is based on Meade and Craig's (2012) recommendations for conducting online surveys. In response to this item, six participants declared that they had given untrue answers and were excluded from analyses on that basis. The sample size was 399 after these participant exclusions.

Procedure

Participants completed an online study titled "Starting University". In the Information Statement, participants were informed that the current study was

“examining the effect of starting university on students’ lives.” Participants were informed prior to commencing the study that they would be asked to respond to a series of statements that indicated aspects of starting university and to respond to questions regarding their personalities and demographics.

Participants completed a battery of 15 psychometric scales. To prevent presentation-order effects, these scales were presented in randomized order, except for items relating to demand characteristics, truthful responding, demographics and social class, which were positioned at the end of the questionnaire. I included scales that measured participants’ personalities, problem-solving styles, and perceived quantity and quality of available help. I also assessed participants’ academic performance using objective indicators such as participants’ end of year academic results and their self-reported Australian Tertiary Admissions Rank. I also employed psychometric measures to assess students’ subjective perceptions of their academic performance, perceived task difficulty, and previous feedback from university. Further, I measured participants’ social integration at university in terms of their sense of belonging, community support, and friendships at university. Finally, participants were asked questions regarding demand characteristics, truthful responding, demographics, and social status. The median duration that participants took to complete the study was 14 minutes.

Measures

I originally included a series of additional measures in this study and in Studies 2, 3, and 4. For the sake of brevity, I only discussed measures in detail that yielded theoretically-informative results. However, a full list of measures is reported for each study in the Appendix. Except where indicated, all responses were made on a 7-point Likert-type scale anchored *strongly disagree* and *strongly agree*.

Problem-solving style. Individual differences in independent-interdependent problem-solving were measured using Version 2 of the IIPSS (Rubin, 2011c). As discussed previously, the initial version of the IIPSS has good convergent and divergent validity as well as good reliability (Rubin et al., 2012) and Version 2 of the IIPSS has satisfactory reliability (Vieira, 2013). The IIPSS was the only scale currently available that measures the dimension of independent-interdependent problem-solving in a non-specific context. Hence, the scale was useful for comparing participants' independent-interdependent problem-solving styles across different studies with varying focus points. An example item for interdependent problem-solving is "I prefer to consult with others before making important decisions," and an example item for independent problem-solving is "I prefer to make decisions on my own, rather than with other people." Table 3.1 presents the full list of IIPSS items.

Personality traits. The Big Five personality traits were assessed with the 44-item Big Five Inventory (BFI; John & Srivastava, 1999). The BFI measures the personality traits of openness to experience, neuroticism, agreeableness, extraversion, and conscientiousness. According to John and Srivastava (1999), each trait dimension subsumes the following facets: Openness to experience describes openness, originality, and open-mindedness; neuroticism describes neuroticism, negative affectivity, and nervousness; agreeableness describes agreeableness, altruism, and affection; extraversion describes extraversion, energy, and enthusiasm; conscientiousness describes conscientiousness, control, and constraint. Eight to 10 items measuring the three respective facets make up each trait dimension. John and Srivastava reported Cronbach alpha reliabilities in American and Canadian samples between .75 and .90, and test-retest reliabilities between .80 and .90 during a three-month period. Evidence of substantial convergent validity was found with other Big Five instruments such as the

NEO Five Factor Inventory (Costa & McCrae, 1992) and the Trait Descriptive Adjectives (Goldberg, 1992).

I chose the BFI for two reasons. First, the BFI is time economic compared to other measures (see John & Srivastava, 1999), which is useful for preventing participant fatigue effects. Second, comparisons between the above-mentioned personality assessment tools showed that the short phrases given in the BFI are less abstract using natural language and consequently easier for participants to understand (see John & Srivastava, 1999). An example item for openness is “I see myself as someone who is original, comes up with new ideas,” and an example item for neuroticism is “I see myself as someone who gets nervous easily.” An example item for agreeableness is “I see myself as someone who is helpful and unselfish with others,” and an example item for extraversion is “I see myself as someone who is outgoing, sociable.” An example item for conscientiousness is “I see myself as someone who does a thorough job.”

Demand characteristics and truthful responding. Demand characteristics, as described by Orne (1962), are specific cues of the experimental situation that raise participants’ awareness of the research aims and, as a consequence, may alter participants’ naturalistic responses. To examine the potential influence of demand characteristics, we included the 4-item Perceived Awareness of the Research Hypothesis scale (PARH; Rubin, Paolini, & Crisp, 2010). Rubin et al. (2010) developed the PARH scale to assess participants’ awareness of the research hypothesis in a closed-ended, quantitative way. According to Rubin (2010, para 4), the PARH scale balances two approaches that bear some disadvantage when used individually. On the one hand, indirect open-ended questions such as “What do you think the research is about?” can lead participants to give an overly uncertain response. On the other hand, declaring the research aims before asking whether participants detected those aims can

promote an overly certain response. The PARH measure has good internal consistency (Cronbach's $\alpha = .77$ & $.81$; Rubin et al., 2010). An example item is "I knew what the researchers were investigating in this research."

Based on Meade and Craig's (2012) suggestions about how to identify careless responses in online surveys, we also included a self-reported single-item indicator that sought to identify participants who did not respond truthfully to the survey items. Participants read the item "Did you answer truthfully to all of the given questions in this survey?" and answered in a simple "yes" or "no" response format.

Demographics and social class. Standard demographic items were measured, including age, gender, and nationality. In addition, participants completed a brief measure concerning their social status. Following several previous investigations (Ostrove & Long, 2007; Rubin et al., 2014; Rubin & Wright, in press; Soria, Stebleton, & Huesman, 2013), I included a subjective single-item measure of social class. Participants responded to the item "My social class is..." by choosing one of the following categories: *working-class*, *lower middle-class*, *middle-class*, *upper middle-class*, or *upper class*. For participants who were unsure of their social class, I included a *don't know* response option.

Results

Preliminary Analyses

Missing values. With the exception of social class and demographic items, all responses were mandatory. In other words, even though participation was voluntary and could be terminated at any time during the survey, only demographic and social class responses could be skipped. All other items needed to be completed in order to proceed to the next page of the survey. Eleven participants did not respond to the social class item, three participants did not indicate their age, three participants did not

indicate their ethnicity, and two participants did not indicate their age as well as their ethnicity. To examine whether participants who declined to answer any of the social class or demographic questions significantly differed from other participants concerning their personalities and problem-solving styles, I employed a Little's (1988) Missing Completely at Random test. The Missing Completely at Random test did not yield a significant result ($\chi^2 = 64.53$, $df = 58$, $p = .259$), indicating that there was no evidence to assume that missing cases depended on key variables subject to analyses (see Little, 1988). Because the number of missing cases on social class, age, and gender was reasonably small and there was no indication that the missing cases were influencing any of the variables under the main research question, I decided to pairwise delete the missing cases.

Outliers. In this study and in the following studies, I screened for univariate outliers following Osborne and Overbay's (2004) recommendations. I noted cases that lay outside three standard deviations of the mean for each variable. Due to the regression analyses I conducted as part of my second aim, I identified multivariate outliers using Mahalanobis Distance with an alpha criterion of $p < .001$. I detected one multivariate outlier on openness and problem-solving style and three multivariate outliers on problem-solving style, openness, perceived awareness of the research hypothesis, age, and gender. I made each calculation with and without removing outliers in order to examine whether outlier exclusions impacted on the pattern of results.

Normality. Throughout my thesis, I adopted the approach of testing for normality using the Mark One Eyeball Test and screened the variables for skewness and kurtosis. In the current study, all key variables except age showed sufficient convergence with normal distribution curves. Age showed extreme values for skewness

and kurtosis outside the range of +/-2.0. Consequently, I performed a log transformation (base 10) for age. While the transformation achieved a normalisation for the skewness, the log10 transformed age variable remained above the acceptable range for kurtosis (2.84), indicating that statistical procedures based on variances and covariances may be affected (see DeCarlo, 1997). Consequently, outcomes for the age covariate should be interpreted with caution.

Coding of the IIPSS. Note that throughout my thesis, I have coded the IIPSS in a way such that higher scores indicated a greater *independent* problem-solving style. To be clear, the IIPSS was coded so that lower scores represented participants' tendencies for interdependent problem-solving and higher scores represented participants' tendencies for independent problem-solving. Medium levels of problem-solving style describe cases in which participants indicated no clear relative preference of either problem-solving style. This procedure is consistent with the scoring method described by Rubin et al. (2012).

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure. Following Russell (2002) and Widaman (1993), I investigated the factor structure of independent IIPSS items and reverse scored interdependent IIPSS items using a principal axis factor analysis with promax rotation. The Kaiser-Meyer-Olkin value of .90 indicated "marvelous" sample adequacy for a factor analysis to proceed (Kaiser, 1974, p. 204).

I used two approaches to determine the number of factors to extract. First, I used Cattell's (1966) scree plot approach in which I inspected a graphical representation of the eigenvalues in descending order. Figure 3.1 shows the scree plot, which suggested that the slope tails off after the first factor and the second factor remains in the elbow.

To determine whether to retain the factor in the elbow, I employed a second approach. Following Wilson and Cooper (2008), I used parallel analysis (Horn, 1965). A way to conduct parallel analysis is the Watkins' (2000) Monte Carlo simulation software. The software generates a series of data sets that simulate the experimental data. If the eigenvalues for the factors from the experimental data set are larger than the simulated eigenvalues, then it can be concluded that the respective factors are present in the data set.

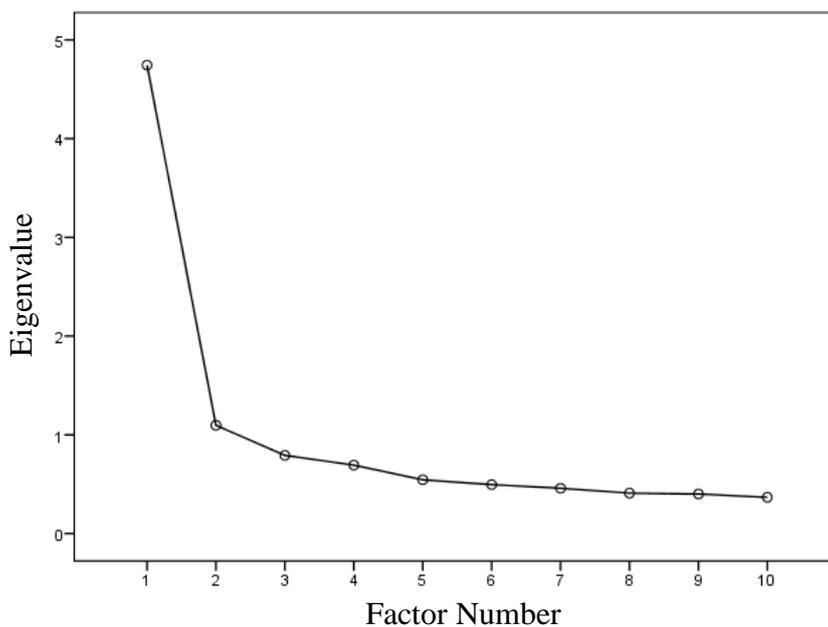


Figure 3.1. Cattell's scree plot for the IIPSS items.

The results of the parallel analysis with 100 random data sets, 10 variables, and 399 participants showed that only the eigenvalue of the first factor exceeded the eigenvalues of the first factor in the simulated data sets ($4.75 > 1.25$). The eigenvalue of the second factor was smaller than the second simulated eigenvalue ($1.10 < 1.17$). Consequently, I specified the extraction of only one factor using the promax method of oblique rotation (see Fabrigar, Wegener, MacCallum, & Strahan, 1999; Russell, 2002).

I set the Kappa value to 3. According to Tataryn, Wood, and Gorsuch (1999), this provides the least error and bias.

Table 3.1 displays the loadings of the one factor solution in the resulting factor matrix. The factor accounted for 47.45% of the total variance and had an eigenvalue of 4.75. All items had factor loadings that exceeded the cut-of criteria of .30 and ranged between .55 and .73. The item “In general, I do not like to ask other people to help me to solve problems” had the largest loadings of all IIPSS items and describes independent problem-solving.

Table 3.1

Item Loadings for the 10-item IIPSS Version 2

Item	Factor
1) In general, I do not like to ask other people to help me to solve problems.	.73
2) I like to get advice from my friends and family when deciding how to solve my personal problems.*	.70
3) I prefer to make decisions on my own, rather than with other people.	.67
4) I do not like to depend on other people to help me to solve my problems.	.66
5) I would rather struggle through a personal problem by myself than discuss it with a friend.	.65
6) I usually prefer to ask other people for help rather than to try to solve problems on my own.*	.64
7) I prefer to consult with others before making important decisions.*	.63
8) I usually find other people’s advice to be the most helpful source of information for solving my problems.*	.63
9) I value other people’s help and advice when making important decisions.*	.58
10) When faced with a difficult personal problem, it is better to decide yourself rather than to follow the advice of others.	.55

Note. Items with asterisk are reverse scored.

Descriptive statistics. Table 3.2 provides the mean ratings and Cronbach's alphas for IIPSS items, personality traits, social class and perceived awareness of the research hypothesis. Internal consistencies of multi-item scales and subscales were all acceptable with Cronbach's alphas ranging from .74 to .90. Social class was a single-item measure and was thus not applicable for internal reliability measures.

Table 3.2

Descriptive Statistics for Person-based Variables, Social Class, and Perceived Research Awareness

	Mean	SD	Alpha
IIPSS	3.68	1.04	.87
Openness	4.73	.78	.74
Neuroticism	4.14	1.16	.85
Agreeableness	5.36	.88	.83
Extraversion	4.43	1.06	.86
Conscientiousness	4.81	.87	.81
Social Class	3.00	.95	N/A
PARH	4.71	1.26	.90

Note. N/A = not applicable. All scales had a theoretical range of 1 to 7 apart from social class, which had a theoretical range of 1 to 5.

Correlations. Table 3.3 shows the Pearson correlations between variables. Consistent with previous research (Rubin et al., 2012), a more independent problem-solving style was moderately and negatively associated with extraversion, indicating that independent problem-solvers are less extraverted than interdependent problem-solvers. In addition, there was a moderate and negative correlation between problem-solving style and agreeableness, indicating that more independent problem-solvers are less agreeable than interdependent problem-solvers. Confirming the divergent validity of the IIPSS, problem-solving style was not significantly correlated with the personality traits of openness and neuroticism and conscientiousness.

Table 3.3

Pearson Correlations Between Variables

Variables	1	2	3	4	5	6	7
1. IIPSS	—	—	—	—	—	—	—
2. Openness	.01	—	—	—	—	—	—
3. Neuroticism	.03	-.16**	—	—	—	—	—
4. Agreeableness	-.29**	.25**	-.34**	—	—	—	—
5. Extraversion	-.32**	.34**	-.38**	.34**	—	—	—
6. Conscientiousness	-.08	.17	-.22**	.37**	.28**	—	—
7. Social Class	-.15**	.00	-.18**	-.01	.19**	.01	—
8. PARH	-.13**	.12*	-.13*	.22**	.23**	.19**	.07

Note. Two-tailed correlations * $p < .05$, ** $p < .001$, $N = 399$; PARH = Perceived Awareness of the Research Hypothesis

There was a weak negative correlation between problem-solving style and participants' social class indicating that, consistent with expectations, independent problem-solvers tend to have a lower social status than interdependent problem-solvers.

In relation to the second research aim, the aforementioned null correlation found between problem-solving style and openness further indicated that the independent variables contained no redundant information and that they were genuinely independent from one another (see Tabachnick & Fidell, 1989). Neuroticism (i.e., the dependent variable) showed a weak negative relation with openness, indicating that neuroticism was associated with lower levels of openness.

Interestingly, the PARH measure correlated weakly but significantly negative with neuroticism. This indicated that lower levels of neuroticism were associated with higher levels of demand characteristics. Because we found some evidence that demand characteristics may be related to the outcome variable of neuroticism, we set a more conservative criterion of +2.50 (earlier + 3.0) standard deviations from the mean PARH

value to identify participants who felt confident that they were aware of the research hypotheses. However, no participant reached this cut off point, suggesting that all participants felt unclear about the research aims. Nonetheless, I included the PARH index as a covariate in subsequent regression analyses in order to control for potential effects of this variable.

Gender differences. I employed independent samples *t* tests to investigate gender differences on the variables. There were significant gender differences in relation to problem-solving style, openness, neuroticism, agreeableness, and conscientiousness. Consistent with predictions, men showed a significantly greater independent problem-solving style ($M = 3.92, SD = 1.05$) than women ($M = 3.61, SD = 1.03$), $t(397) = 2.57, p = .011$. Men were also more open to experience ($M = 4.93, SD = 0.82$) than women ($M = 4.67, SD = 0.75$), $t(397) = 2.91, p = .004$. Consistent with previous research (Budaev, 1999; Lippa, 2010; Schmitt, Realo, Voracek, & Allik, 2008; Weisberg, DeYoung, & Hirsh, 2011), women were (a) more neurotic ($M = 4.30, SD = 1.08$) than men ($M = 3.62, SD = 1.33$), $t(397) = -4.42, p < .001$, and (b) more agreeable ($M = 5.43, SD = 0.83$) than men ($M = 5.13, SD = 1.02$), $t(397) = -2.86, p = .005$. Also in line with previous research (Kling, Nofhle, & Robins, 2013; Lippa, 2010; Schmitt et al., 2008), women were also more conscientious ($M = 4.86, SD = 0.98$) than men ($M = 4.64, SD = 0.98$), $t(397) = -2.11, p = .036$. Although women scored higher on extraversion ($M = 4.44, SD = 1.04$) than men ($M = 4.41, SD = 1.15$), this difference was not significant in the current study, $t(397) = -0.22, p = .830$.

Given the clear influence of gender on problem-solving style, openness and neuroticism, I decided to include gender as a covariate in subsequent regression analyses. In addition, because age is a common covariate along with gender, I controlled for both age and gender in this study.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

I conducted several analyses to investigate the relation between personality and IIPSS. I only report here a potentially theoretically-important finding that I subsequently replicated in our additional studies. In the following, I will treat neuroticism as an outcome variable. Neuroticism has been used as a dependent variable in previous research, often as a conceptualisation of trait anxiety (e.g., Jorm, 1989; Munafò et al., 2005; Schinka et al., 2004). Because I consider neuroticism as chronic experiences of negative emotionality (see Bouchard, 2003), treating neuroticism as an outcome variable is not problematic. I addressed this issue in greater depth in the General Introduction.

Moderating effect of openness. To examine whether openness moderated the relation between independent-interdependent problem-solving style and neuroticism, I computed regression analyses using Model 1 of Hayes' (2013) PROCESS software. PROCESS examines (a) the conditional effect of the predictor variable X on an outcome variable Y when the moderator variable M is at the sample mean and, conversely, the conditional effect of M on Y when X is at the sample mean¹. PROCESS further examines (b) the interaction effect between X and M in a model of Y , and (c) the conditional effects of X (a.k.a. "simple slopes") on Y on various levels of M (see Hayes, 2012; 2013). Model 1 of the PROCESS software tests for a two-way interaction using the product of the predictor and moderator variables, and it tests for conditional effects using the pick-a-point approach (Rogosa, 1980). Because PROCESS combines the

¹ In particular, PROCESS tests the conditional effects of X and M on Y when the other predictor variable is *zero*. For mean centred predictor variables, like I used throughout my thesis, zero constitutes the *sample mean* of the other predictor variable. Consequently, the conditional effects of X and M on Y when the other predictor variable equals zero are similar but *not identical* to main effects (see Hayes, 2013, p. 318).

possibilities of comparable software tools such as SOBEL (Preacher & Hayes, 2004) and MBESS (Kelley, 2007) with the additional option of controlling for covariates, I used PROCESS throughout my thesis.

In the present research, openness and problem-solving style were mean centred prior to analysis. Mean centering of predictor variables is a widely recommended approach that I used in all subsequent analyses (see Hayes, 2013). There was a significant effect of openness on neuroticism when problem-solving was at the sample mean, $b = -.21$, $SE = .07$, $t = -2.86$, $p = .005$, 95% CI [-.36, -.07], but no significant relation between problem-solving style and neuroticism when openness was at the sample mean, $b = .03$, $SE = .06$, $t = .53$, $p = .594$, 95% CI [-.08, .14]. There was also a significant interaction between problem-solving style and openness in predicting neuroticism, $b = -.25$, $SE = .07$, $t = -3.68$, $p < .001$, 95% CI [-.39, -.12], indicating that the effect of problem-solving style on neuroticism was linearly dependent on openness.

Figure 3.2 illustrates the conditional effects of problem-solving style on neuroticism at varying values of openness. At low levels of openness (one standard deviation below the mean), independent problem-solving style had a significant positive effect on neuroticism, $b = .23$, $SE = .08$, $t = 2.96$, $p = .003$, 95% CI [.08, .38], indicating that the more participants had an independent problem-solving style, the greater their level of reported neuroticism. At medium levels of openness, problem-solving style did not predict neuroticism, $b = .03$, $SE = .06$, $t = .53$, $p = .594$, 95% CI [-.08, .14]. At high levels of openness (one standard deviation above the mean), problem-solving style had a significant negative effect on neuroticism, $b = -.17$, $SE = .08$, $t = -2.16$, $p = .032$, 95% CI [-.32, -.02].

Overall, the pattern of results remained the same after controlling for age, gender, perceived awareness of the research hypothesis, and univariate and multivariate

outliers. However, there was one exception concerning the conditional effect of independent problem-solving on neuroticism at high levels of openness. At high levels of openness, the negative effect of problem-solving style on neuroticism only approached significance after controlling for outliers, $b = -.15$, $SE = .08$, $t = -1.83$, $p = .068$, 95% CI $[-.30, .01]$.

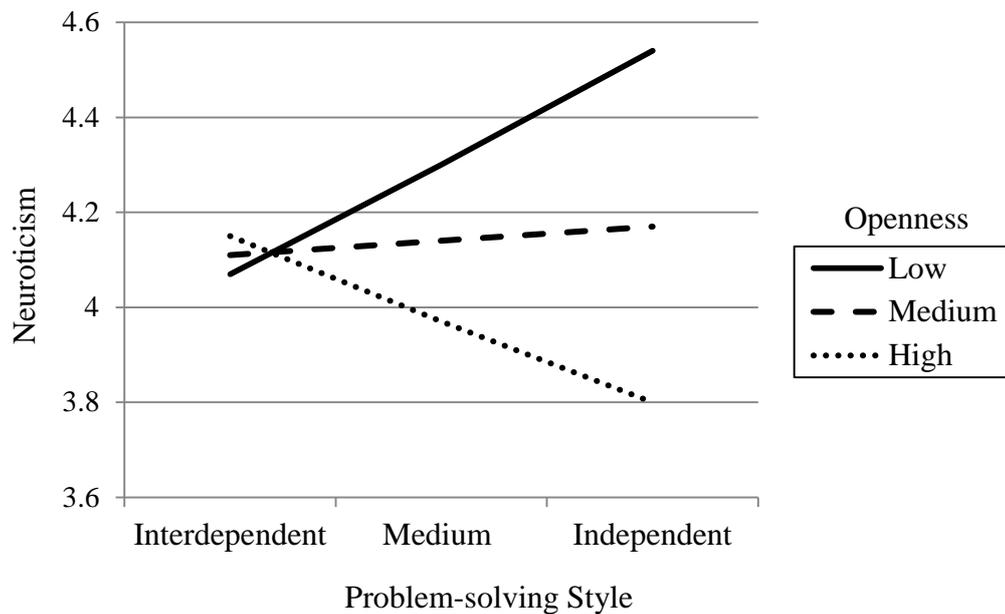


Figure 3.2. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness. Low ($-1 SD$) levels of problem-solving style were labelled interdependent, medium (M) levels of problem-solving style were labelled medium, and high levels ($+1 SD$) of problem-solving style were labelled independent.

In summary, I found that openness moderated the relation between problem-solving style and neuroticism. Participants with an independent problem-solving style experienced more neuroticism when openness was low. At high levels of openness, the effect turned around in that *interdependent* problem-solving style predicted higher levels of neuroticism. When openness levels were in the medium ranges, problem-solving style did not predict neuroticism.

Discussion

Aim I: Testing the Psychometric Properties of the IIPSS

My first aim was to investigate the psychometric properties of Version 2 of the IIPSS. I employed a principal axis factor analysis to determine whether the IIPSS had a one- or two-factor structure. As expected, I identified a single factor structure for Version 2 of the IIPSS. Further analyses revealed that Version 2 of the IIPSS had good internal reliability. Confirming the convergent validity of the measure, the IIPSS correlated significantly and negatively with the socially-based personality dimensions of agreeableness and extraversion. Confirming the divergent validity of the IIPSS, problem-solving showed no significant correlations with the traits of openness, neuroticism, and conscientiousness.

Factor structure. In the Introduction, I put forward several reasons why I expected a single factor structure rather than a two-dimensional factor structure. I highlighted important differences in the implications of the dimensionalities. In a unidimensional model, independent and interdependent problem-solving are conceptualized as opposite poles of a single underlying dimension. For example, an independent problem-solving item is “I prefer to make decisions on my own, rather than with other people,” and an interdependent problem-solving item is “I prefer to consult with others before making important decisions.” I argued that it is likely that people vary in the degree that they prefer one approach over the other. In contrast, a two-dimensional approach would position people on an independent problem-solving dimension *and* an interdependent problem-solving dimension. Under this latter conceptualisation, two unintended implications would arise. First, for individuals scoring low on both problem-solving dimensions, the IIPSS would be an indicator of the *amount* of independent and interdependent problem-solving rather than *preference*

for one style over the other. Second, in the case of individuals scoring high on independent and interdependent problem-solving, this would present a conceptually illogical position in which the same person could favour *both* forms of problem-solving styles.

As described in Chapter 2, the factor structure of the IIPSS has been investigated previously, both for Version 1 of the IIPSS (Rubin et al., 2012) and for Version 2 (Vieira, 2013). There are minor differences between the factor analyses conducted by Rubin et al. (2012), Vieira (2013), and the current analysis that should be noted. Rubin et al. investigated the earlier version of the measure that consisted of 12 items. Despite employing the second version of the IIPSS, I obtained the same single factor structure for the second version as for the first version of the IIPSS. The sample size used in Vieira's factor analysis was relatively small ($N = 79$). Although there is no clear consensus on the appropriate sample size in factor analysis (see Mundfrom, Shaw, & Ke, 2005 for a discussion on this topic), many recommendations do not advise sample sizes smaller than 100 participants (Comrey & Lee, 1992; Gorsuch, 1983; Guadagnoli & Velicer 1988; Hatcher & Stepanski, 1994; Hutcheson & Sofroniou, 1999; Kline 1994; Russell, 2002). For example, Russell (2002) recommended that "samples of 100 cases or more should be used" (p. 1642) and Comrey and Lee (1992) regarded a sample size of 100 as "poor" (p. 217). In the current study, the sample consisted of 408 research participants. Hence, the present study was likely to give more reliable results than Vieira's factor analysis. In line with Rubin et al.'s findings ($N = 137$), I obtained a single factor structure of the IIPSS.

Internal consistency. As mentioned in Chapter 2, the IIPSS had good internal consistency in previous research (Rubin et al., 2012; Vieira, 2013). In the current study, the Cronbach's alpha of Version 2 ($\alpha = .87$) was comparable to the Cronbach's alpha of

Version 1 ($\alpha = .81$; Rubin et al., 2012) and higher than Vieira's (2013) independent and interdependent factors ($\alpha = .77$ & $\alpha = .78$, respectively). That the internal consistency values found in Rubin et al.'s (2012) study and in the current study were higher than in Vieira's (2013) study is not surprising because the Cronbach's alpha value increases with greater item numbers (see Cortina, 1993). Consequently, splitting the IIPSS into two factors is likely to decrease the Cronbach's alpha value for each subscale, whereas retaining all items on one factor increases the Cronbach's alpha value of the scale. Overall, the Cronbach's alphas were above .80 for a single dimensional structure. Results of the present investigation confirmed good internal consistency for Version 2 of the IIPSS.

Construct validity. In support of its convergent validity, the IIPSS correlated significantly and in the expected direction with agreeableness and extraversion ($r_s = -.29$ & $-.32$, respectively). In the Introduction, I argued that an interdependent problem-solving style should be related to agreeableness and extraversion because the traits of agreeableness and extraversion are interpersonal in their nature (McCrae & Costa, 2003; John & Srivastava, 1999). This assumption is consistent with previous findings. In regards to relational interdependent self-construal, the RISC scale (Cross et al., 2000) showed medium positive correlations with agreeableness ($r = .35$) and extraversion ($r = .28$), indicating that agreeable and extraverted individuals tend to have greater interdependent self-construals. Similarly, Rubin et al. (2012) found that Version 1 of the IIPSS had a small-to-medium but significant negative correlation with Goldberg et al.'s (2006) Extraversion Scale ($r = -.19$), indicating that extraverted individuals tend to prefer an interdependent problem-solving style.

Establishing the divergent validity of the IIPSS, I found no significant correlations between the IIPSS and neuroticism and openness and conscientiousness.

These results are consistent with Cross et al.'s (2000) findings showing no significant correlations between the RISC scale and neuroticism and openness, and the results are also consistent with previous findings showing that openness did not predict individuals' preferences for interpersonal problem-solving across the adult lifespan (Blanchard-Fields & Camp, 1990). In addition, the nonsignificant correlation between problem-solving style and conscientiousness is consistent with Watson and Hubbard's (2006) findings showing no significant correlation between instrumental support seeking and conscientiousness.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

In an exploratory analysis of the relations between the Big Five and problem-solving style, I found that openness moderated the extent to which first-year students' problem-solving styles predicted their level of neuroticism. Conditional effects analyses showed that an independent problem-solving style predicted greater levels of neuroticism among those individuals who were low in openness. The effect turned around for individuals high in openness. When openness was high, an *interdependent* problem-solving style predicted greater levels of neuroticism. However, this finding was only marginally significant after the exclusion of outliers. When participants had medium levels of openness, there was no significant effect of problem-solving style on neuroticism.

Matching hypothesis. The present findings suggest that the extent to which a preference for independent problem-solving over interdependent problem-solving leads to greater negative emotional outcomes depends on individual differences in openness to experience. I presented previous findings in the Literature Review showing that openness to experience is positively related to cognitive engagement, positive problem-

solving approaches, and self-efficacy (Bouchard, 2003; Chi & Glaser, 1985; DeYoung, 2014; DeYoung et al., 2014; Hartman & Betz, 2007; Kaufman, 2013; Kaufman et al., 2010; McMurrin et al., 2001; Moberg, 2001; Nauta, 2004; Penley & Tomaka, 2002; Rottinghaus et al., 2002; Zillig et al., 2002). Based on this previous work, I assumed that individuals who are high in openness to experience would express more positive appraisals during independent problem-solving situations, which could alter when an independent versus an interdependent problem-solving preference is predictive of greater negative affect.

To explain the present findings, I put forward a *matching hypothesis* that is based on the match between problem-solving style, as represented by the IIPSS, and positive problem-solving appraisal, as represented by openness. Specifically, I proposed that an *independent* problem-solving style constitutes the best match for individuals who are *high* in openness because their preference to solve problems on their own matches their relatively high perceived competence to solve problems in constructive ways. Independent problem-solvers who are high in openness are therefore more likely to experience greater confidence regarding the problem-solving process, which, in turn, would lead to a less negative emotional state. Hence, I proposed that *independent* problem-solvers who are *high* in openness would score relatively *low* in neuroticism because their preferred problem-solving style (independent) matches their belief that they are able to solve problems on their own (high openness), which results in a less negative emotional state (low neuroticism). In contrast, *interdependent* problem-solvers who are high in openness would score relatively *high* in neuroticism because their preference to involve others in the problem-solving process conflicts with their relatively high perceived competence in independent problem-solving and so results in less effective problem-solving appraisals, and, consequently, a more negative

emotional state. Hence, assuming that problem-solving style is coded such that high scores represent independent problem-solving and low scores represent interdependent problem-solving, there would be a *negative* relation between independent problem-solving style and neuroticism among people who are high in openness.

Contrasting propositions can be derived in relation to people who are *low* in openness. Specifically, an *interdependent* problem-solving style constitutes the best match for individuals who are *low* in openness because assistance from others is likely to result in more effective problem-solving appraisals among people who believe that they lack the ability to solve problems on their own. Hence, I proposed that *interdependent* problem-solvers who are *low* in openness would score relatively *low* in neuroticism because their preferred problem-solving style supplements their perceived lack of ability to solve problems on their own which, in turn, results in greater confidence regarding the problem-solving process and a less negative emotional state. In contrast, *independent* problem-solvers who are low in openness would score relatively *high* in neuroticism because their preference to solve problems on their own is frustrated by their perceived low competence in this area. They feel that their endeavours are likely to result in ineffective problem-solving and, consequently, they experience a more negative emotional state. Hence, there would be a *positive* relation between independent problem-solving style and neuroticism among people who are *low* in openness.

In summary, I proposed a *matching hypothesis* that explained how matches between problem-solving style and openness resulted in lower levels of neuroticism and better mental health outcomes compared to mismatches. The key assumption behind these propositions is that matches between one's problem-solving ability appraisals (openness) and preferred style (IIPSS) lead to more constructive problem-solving

approaches, a sense of confidence regarding the problem-solving process and its outcomes, and a less negative emotional state. In contrast, mismatches lead to less favourable problem-solving appraisals, a sense of emotional uneasiness with the problem-solving process and its outcomes, and negative emotionality. I further assume that, in the long term, these emotional outcomes become entrenched in personality and reflected in individual differences in neuroticism. Figure 3.3 illustrates how matching styles to solving problems at high and low levels of openness predict less pronounced negative affect compared to mismatching styles.

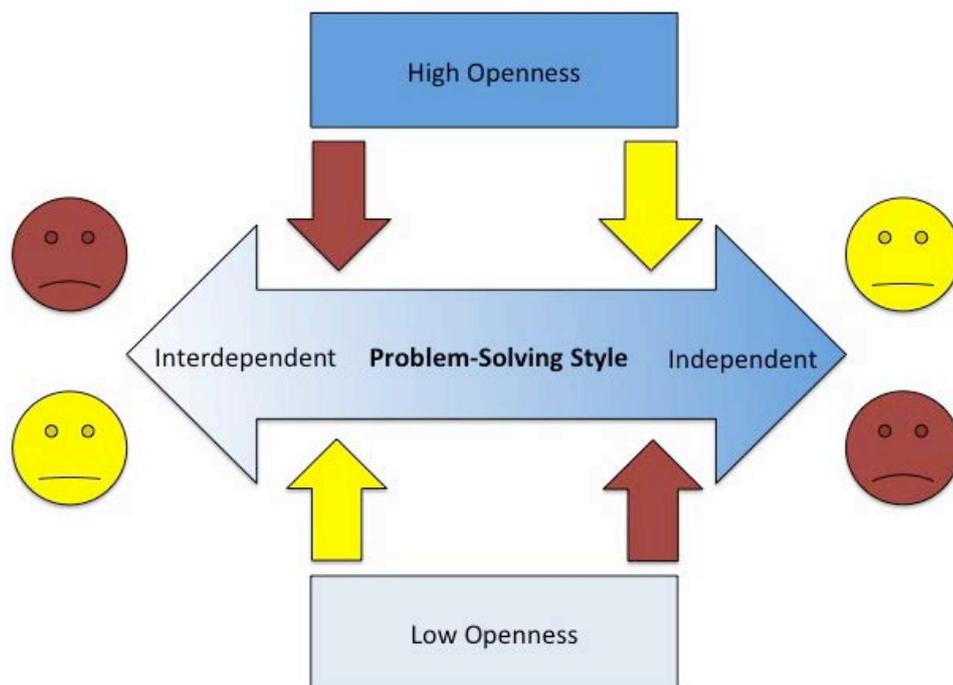


Figure 3.3. Diagram illustrating how matches (illustrated by yellow arrows) and mismatches (illustrated red arrows) between problem-solving styles and levels of openness to experience predict relative intensities of negative emotionality (indicated by sad and neutral faces).

Limitations and Alternative Explanations

Limitations. There are several limitations to be noted in the present study. One limitation is that the dependent variable was a chronic dispositional trait measure of

neuroticism. While it may be unusual to investigate neuroticism as an outcome variable, this approach has been used in many other previous studies (e.g., Beech, 2001; Engeli et al., 2014; Farmer et al., 2002; Goodwin & Hamilton, 2002; Zanon & Hutz, 2013). In addition, neuroticism is often conceptualized as “trait anxiety” (e.g., Jorm, 1989; Munafò et al., 2005; Schinka et al., 2004). Generally, neuroticism describes emotional lability, negative emotionality, and a vulnerability to stress and anxiety (Costa & McCrae, 1980; Costa & McCrae, 1987; Eysenck & Eysenck, 1975; John & Srivastava, 1999). Bouchard (2003) pointed out that neuroticism “... is the dimension underlying the chronic experience of distressing emotions” (p. 2). Hence, it can be argued that neuroticism is a marker of negative affective states such as stress, anxiety, and depression (see also Lovibond & Lovibond, 1995) and as such can be used as a dependent variable. Nonetheless, I tested these ideas using more state-based measures of depression, anxiety, and stress in Study 4, which is covered in Chapter 6.

Another limitation is the unequal number of men and women that volunteered to participate in the current study. This unequal gender ratio limits the generalizability of the present findings concerning gender differences. Therefore, this result requires replication. However, I should add that because participation in all studies under the current research project is voluntary, there is no means of guaranteeing that the gender ratio will be more representative in subsequent studies.

Finally, the matching hypothesis was formulated to explain the conditional effects at low and high levels of openness. However, while (a) the interaction between problem-solving style and openness and (b) the conditional effect of problem-solving on neuroticism at low levels of openness persisted after controlling for outliers, the conditional effect of problem-solving on neuroticism at high levels of openness did not.

Hence, it appears that the effect at high levels of openness is less robust than the effect at low levels of openness.

Alternative explanations. Alternative explanations for the current findings need to be considered. One alternative explanations concern the interaction effect of openness to experience and problem-solving style on neuroticism and another alternative explanation concerns the possible influence of socially desirable responding.

First and most importantly, the interaction effect of openness and problem-solving style on neuroticism could be due to a Type I error because the interaction effect was found on an exploratory basis. Kerr (1998) pointed out that the danger of theorizing a posteriori is that a Type I error – falsely stating that an effect is genuine – may lead the researcher to fabricate a theory around an erroneous finding. To prevent this possibility, several researchers proposed the necessity to replicate such findings in follow-up studies (Hays, 1994; Kerr, 1998; Murayama, Pekrun, & Fiedler, 2014). Further, an empirically inspired theoretical framework should allow for predictions other than the empirical finding in order to be convincing. It is therefore necessary to replicate the interaction effect of openness and problem-solving style and find corroboratory evidence to rule out, or at least greatly minimise, the possibility that a Type I error was responsible for the significant interaction effect in the current study.

Second, social desirability possibly accounted for people's responses regarding their independent or interdependent problem-solving styles. Participants could be motivated to respond to the IIPSS items in a socially desirable way, which would reduce the ecological validity of the results. For example, in the present research, items such as "I would rather struggle through a personal problem by myself than discuss it with a friend" may have sounded like socially undesirable behaviour to some participants and, consequently, those participants avoided agreeing to this item on that ground alone. In

Cross et al.'s (2000) research, the authors ruled out that participants' indications of their self-construal was due to socially desirable responding. I addressed this issue in regards to the IIPSS in Study 2, which is presented in the next chapter.

Implications

Some conclusions can be drawn from the current study that relate to the psychometric properties of the second version of the IIPSS. Overall, the present study found good psychometric properties of the IIPSS, including a single factor structure, good internal consistency, and convergent validities with agreeableness and extraversion in the expected directions. These findings add to previous investigations regarding the IIPSS (Rubin et al., 2012; Vieira, 2013) in two ways: The current findings (1) provided more clarity regarding the factor structure of the IIPSS and (2) provided additional evidence that the IIPSS is a valid and reliable psychometric tool.

Other implications concern a novel moderating effect of openness to experience. Openness and problem-solving style seem to interact to predict neuroticism. This finding expands on previous research of the mental health impact of independent and interdependent problem-solving (e.g., Haaga et al., 1995; Nezu & D'Zurilla, 1989; Kant et al., 1997; Ko et al., 2005; Link & Phelan, 2006). The interaction effect suggests that people's self-efficacy to work in a self-reliant fashion and their preference for independent or interdependent problem-solving interact in a way that may have long-term consequences for their degree of negative emotionality. Although this finding is exploratory in nature, replication of this effect may yield some important implications for mental health care professionals. It appears that openness and independent-interdependent problem-solving style constitute another avenue through which individual differences in solving everyday tasks may lead to negative emotional patterns.

Chapter Four: Study 2. Replication of the Moderating Effect of Openness on the Relation between Independent Problem-Solving and Neuroticism

Introduction

Second Empirical Investigation

The current study was designed to expand on the first and second research aims as well as to address some of the alternative explanations discussed in the previous chapter. The first research aim was to assess the psychometric properties of the IIPSS. The second research aim was to explore the moderating effect of openness on the relation between problem-solving style and negative emotionality.

I discussed alternative explanations for the findings in Study 1. First, the moderating effect of openness on the relation between problem-solving style and neuroticism could be due to a Type I error, especially because it was detected using a posteriori analyses (see Kerr, 1998). Second, the conditional effect of problem-solving on neuroticism at high levels of openness did not persist after controlling for outliers, which indicated that the effect was susceptible to outliers in the data. Third, responses to the IIPSS may have been biased by social desirability tendencies. I discuss each of these issues in further depth below.

The need for replication studies in psychology. The emphasis on replication in the current study was particularly important because the moderating effect of openness was obtained using post hoc analyses, which are more prone to Type I errors than tests of a priori hypotheses (Hays, 1994; Kerr, 1998; Murayama et al., 2014).

A number of incidences in recent years have called into question psychological research practices. For example, an extensive instance of scientific fraud by a renowned social psychologist (see Tilburg University, 2011) and the publication of a

parapsychological phenomenon in a respectable social psychological journal (Bem, 2011) have led to calls to sharpen research practices and policies in psychology. A more general critique on psychological research methods has added to this discussion (e.g., Simmons, Nelson, & Simonsohn, 2011). As part of the discussion, numerous voices in the scientific community have been calling for more replications (e.g., Yong, 2012). The British Psychological Society issued a special edition of *The Psychologist* on the topic of data replication in psychological research. The contributors discussed the value of scientific replication and concluded that replications constitute the foundations of good research practices. For example, Roediger (2012) suggested that “researchers should, whenever possible, replicate a pattern of results before publishing it” (p. 350). In a special section on replications in psychology published in the *Psychology of Aesthetics, Creativity, and the Arts* journal, Makel and Plucker (2014) concluded that, “our research bases need a dialysis separating studies that are creative (i.e., unique and replicable) from those that are merely novel” (p. 29). In the current study, I sought to test whether the results I obtained in Study 1 were reliable, that is, replicable. Because I investigated the moderating effect of openness on an exploratory basis in Study 1, it was essential to replicate this effect to limit the possibility of Type I errors (see Kerr, 1998).

To distinguish between different types of replications, Schmidt (2009) defined direct and conceptual replications. Direct replications describe duplications of previous experimental procedures, whereas conceptual replications describe reproductions of previous experiments with different methods, while still testing the same hypothesis. According to Schmidt, direct replications test whether an effect is *factual*, whereas conceptual replications further the *understanding* and *scope* of an effect.

Schmidt (2009) put forward that a main function of direct replications is to control for Type I errors (i.e., acceptance of a false effect as true). As Schmidt described, the rationale of a Type I error in statistical tests of significance would be based on the assumption that an unrepresentative sample was drawn from the population. Schmidt reasoned that to determine whether a significant effect was due to a Type I error, researchers should replicate their initial experiment with another sample. The second sample drawn from the population would almost certainly be different from the first. The probability of obtaining another Type 1 error in a second sample can be calculated by multiplying the two alpha probabilities together. Presuming an alpha level of .05, the chances of obtaining a Type I error would decline from a 1:20 chance (i.e., 5% chance) in the first sample to a 1:400 chance (i.e., $.05 \times .05 = .0025$, or 0.25% chance, respectively) if the effect was tested again in a second sample.

Another function of direct replication is to control for lack of internal validity in the first examination (Schmidt, 2009). The context in which the research is embedded (e.g., the specifics of the test environment and participant characteristics) could interact with the independent variable to predict the dependent variable in unknown ways. Changes in examination settings would therefore control for some of the contextual variables that threaten internal consistency and increase the confidence that the independent variable caused changes in the dependent variable. As such, replication studies ensure the basic premise of scientific research in that “the experiment reflects knowledge that can be separated from the specific circumstances (such as time, place, or persons) under which it was gained” (Schmidt, 2009, p. 90).

To address both the dependability and the theoretical advancement of research findings, Lishner (2015) recommended a nested replication approach, in which direct replications and conceptual replications are combined in a specific order. For example,

a novel finding that emerged in an initial study would be directly replicated in a second study. If the findings were consistent across the two studies, then a conceptual replication study would be conducted. According to Lishner, these studies could be reported in a single publication to demonstrate both the replicability and the scope of a novel finding.

The theoretical importance of replications is in stark contrast with the low prevalence of replication studies found in psychology and other research disciplines (e.g., Makel, Plucker, & Hegarty, 2012; Schmidt, 2009). Makel et al. (2012) conducted a meta-analytic review of 100 high-impact psychology journals. They found that the percentage of replication studies in psychology was only 1.07% of the overall publications examined. Of these replication studies, 81.9% were conceptual replications and 14% were direct replications. Only 4.1% of replication studies combined both direct and conceptual replications. This lack of replication studies can be viewed as being largely responsible for the persistence and popularity of non-replicable phenomena in psychology (for a discussion, see Yong, 2012). It is important to add, however, that the percentage of replication studies has increased by a factor of 1.84 since the year 2000 (Makel et al., 2012), an increase that indicates the growing acceptance of replications in psychological research practice. Although the practice of direct replication has only recently taken hold in the field of psychology, concrete advice for scholars, institutions, and journals has been formulated (e.g., Asendorpf et al., 2013; Brandt et al., 2014). In summary, the question of replicability has become a key concern in recent years within the scientific community, and efforts to transfer the theoretical groundwork into psychological practice seem promising.

How replication is addressed in the present study. In the current study, I addressed recommendations to replicate findings before publishing them (e.g.,

Roediger, 2012) by conducting replication analyses. As I described previously, I did not design Studies 1 to 4 to test the moderating effect of openness. In that sense, the current study can hardly be called a replication *study* because I did not specifically set up Study 2 to look for the effect in question. Nonetheless, when I identified the moderating effect of openness in Study 1, I conducted a replication *analysis* of this effect using the data of Study 2. This approach is similar to employing a secondary dataset to test a novel hypothesis (Smith et al., 2011; Trzesniewski, Donnellan, & Lucas, 2011), except that the data set was not sourced externally. The aim to investigate the replicability of the psychometric properties of the IIPSS found in Study 1, such as the factor structure and construct validity, remained as originally intended.

It is important to note several differences in the contextual factors of Studies 1 and 2 that had the potential to affect the relations between the main research variables and that, consequently, would increase confidence in the internal validity of the observed effects if they were replicated across the two studies. First, the age distribution and source of Study 1's sample first was slightly different from that of Study 2. In Study 1, only first-year psychology students were eligible to participate. In Study 2, psychology students in their first, second, and third years of study as well as research volunteers were eligible to participate. Consequently, on average, participants in Study 2 were 2 years older than participants in Study 1 ($M = 21.56$, $SD = 5.59$ in Study 1 & $M = 23.39$, $SD = 7.96$ in Study 2). Although this age difference was small, age has been shown to affect responses to personality scales in emerging adulthood (e.g., Roberts, Walton, Viechtbauer, 2006; Vaidya, Gray, Haig, Mroczek, & Watson, 2008). For example, Vaidya et al. (2008) found that in a longitudinal observation of American undergraduate students during the ages of 18 to 24 years, agreement with neuroticism items declined, whereas agreement with all other personality trait items

increased. Consequently, participants' response patterns to the neuroticism and openness items could change and affect the moderating effect of openness on the relation between problem-solving style and neuroticism.

Second, participants took part in Study 1 in Semesters 1 and 2 of 2013, whereas participants took part in Study 2 in Semester 1 of 2014. Differences over the course of the semester, for example in relation to exam periods at university, different seasons of the year, or even broader historical events (see Schmidt, 2009) could influence responses to the key research variables unexpectedly.

Third, in Study 1, all measures except for demographics and demand characteristics were presented in a randomized order. Thus, participants were generally more likely to respond to the key variables towards the middle of the study. In contrast, in Study 2, participants completed the key variables at the beginning of the study. This difference implies that participants in Study 1 were more likely to experience fatigue while responding to the key measures compared to participants in Study 2.

Fourth, because Studies 1 and 2 aimed to test additional aspects concerning the original Aim II, the information statements differed in regards to the descriptions of what the studies were about. Thus, if participants anticipated the research hypotheses, those demand characteristics were likely to be different across the two studies.

Lastly, Study 1 was presented within the Sona System software but Study 2 was presented within the LimeSurvey software (Version 2.05; Schmitz, 2013). According to Schmidt (2009), specific task variables such as typing font and background colour could influence participants' responses. Typing font, background colour, and layout differed between Studies 1 and 2 because of the change in software tools.

In summary, the current study served several functions that were in accordance with Schmidt (2009). First, controlling for a Type I error was particularly important

because the moderating effect of openness was detected in Study 1 after the results were known using post hoc analyses. As described by Kerr (1998), post hoc analyses are more susceptible to Type I errors. Second, potential confounding variables of the research setting were controlled for, such as participant and context factors.

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure of the IIPSS. The results of Study 1 confirmed a single-factor structure as the best fit to the items describing independent and interdependent problem-solving in Version 2 of the IIPSS. This finding was consistent with an earlier inspection of the IIPSS (Rubin et al., 2012) but was in contrast to another investigation that obtained a two-factor structure (Vieira, 2013). The aim of the current study was to investigate the replicability of the single factor structure.

Relation between problem-solving and personality traits. As part of establishing the construct validity of the IIPSS, I expected weak to moderate negative correlations between the IIPSS and the social traits of extraversion and agreeableness. I also expected the IIPSS and neuroticism and openness and conscientiousness to be very weak. Study 1 supported these predictions. In Study 2, I investigated whether these findings could be replicated.

Influence of social desirability on responses to the IIPSS. A limitation of Study 1 was that the potential link of the IIPSS measure to socially desirable responding was not examined. Social desirability describes the tendency of research participants to convey a favourable image of themselves (see van de Mortel, 2008; Paulhus, 1984). A scale's validity is weakened when responses are confounded with socially desirable response patterns (King & Bruner, 2000). Consequently, research disciplines that employ self-report data such as psychology, health sciences, and marketing research

have made specific recommendations to control for social desirability (e.g., King & Bruner, 2000; van de Mortel, 2008).

In their validation study of the RISC scale, Cross et al. (2000) included a measure of social desirability in order to rule out the possibility that answers to the RISC scale were due to favourable self-presentation. The authors found that relational-interdependent self-construal was unrelated to social desirability, as measured by the Marlowe-Crowne Social Desirability scale (Crowne & Marlowe, 1960). Therefore, participants did not respond in socially desirable ways when answering the RISC scale items.

Despite the null findings regarding relational-interdependent self-construal, the IIPSS could elicit socially desirable responses due to the social aspects of the problem-solving context that some of the items convey. For example, the item “I would rather struggle through a personal problem by myself than discuss it with a friend” could be considered in contrast to common standards of reciprocity and instrumental aid among friends (Hall, 2012). As a result, participants may under-report the degree to which they solve problems on their own in order to appear like a “good” friend. Because social desirability was a potential confounding variable, it could weaken the scale validity of the IIPSS (King & Bruner, 2000). To control for this important issue, I added a measure of social desirability to the present investigation.

Summary. In this second study, I tested the psychometric properties of the IIPSS similar to the previous study. I tested whether the single factor structure obtained in Study 1 and by Rubin et al. (2012) could be replicated. I also tested whether the IIPSS showed convergent validity with extraversion and agreeableness and divergent validity with openness and neuroticism and conscientiousness, as shown in Study 1.

Finally, I added a measure of social desirability in order to examine whether responses to the IIPSS could be confounded with tendencies to answer in a socially desirable way.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

In Study 1, I found that openness to experience moderated the effect of problem-solving style on neuroticism. In particular, when the level of openness was low, an independent problem-solving style predicted greater levels of chronic negative emotionality (i.e., neuroticism). In addition, when the level of openness to experience was high, an interdependent problem-solving style predicted greater levels of neuroticism.

I noted a matching hypothesis that may be suitable to explain this effect. I proposed that matches between problem-solving style and openness resulted in lower levels of neuroticism and better mental health outcomes compared to mismatches. In particular, I assumed that an *independent* problem-solving style would constitute the best match for individuals who are *high* in openness because people's preference to solve problems on their own might match their relatively high perceived competence to solve problems in constructive ways. I also assumed that an *interdependent* problem-solving style would constitute the best match for individuals who are *low* in openness because assistance from others might result in more effective problem-solving appraisals among people who believe that they lack the ability to solve problems on their own. The key assumption behind these propositions is that matches between one's personal problem-solving ability appraisals (openness) and preferred style (IIPSS) would lead to more constructive problem-solving approaches, a sense of confidence regarding the problem-solving process and its outcomes, and a less negative emotional state compared to mismatches. In contrast, mismatches would lead to less favourable

problem-solving appraisals, a sense of emotional uneasiness with the problem-solving process and its outcomes, and negative emotionality. I further assumed that, in the long term, these emotional outcomes would become entrenched in personality and reflected in individual differences in neuroticism. The current investigation aimed to replicate (on a data analytical level) the moderating effect of openness that I detected in Study 1.

One limitation of the previous study was that the moderating effect of openness on the relation between independent problem-solving and neuroticism may have been biased due to socially desirable response tendencies. This issue is separate from that of the scale validity of the IIPSS. Instead, it relates to the validity of the interaction between openness and problem-solving style in predicting neuroticism. Ones, Viswesvaran, and Reiss (1996) found that agreeableness and neuroticism are significantly influenced by tendencies for socially desirable responding. Because Study 1 indicated that agreeableness and interdependent problem-solving were associated person-based variables, it was possible that interdependent problem-solvers showed a greater tendency to under-report their true levels of neuroticism in order to convey a more favourable picture of themselves. In the current study, I addressed this limitation by including a measure of social desirability as a covariate in my analysis of the relations between openness, independent problem-solving, and neuroticism.

Overview of Study 2

The current research study, as presented here, had two main aims: (a) to test the replicability of the psychometric properties of the IIPSS found in Study 1, and (b) to test the replicability of the moderating effect of openness on the relation between independent problem-solving and neuroticism. In addition, I tested whether responses to the IIPSS could be explained in terms of socially desirable responding and whether social desirability influenced the moderating effect of openness. This possibility was

not previously explored but it beared important implications for the validity of the IIPSS and for testing a potential confounding variable that could impact on the moderating effect of openness.

In the present study, undergraduate psychology students at an Australian university completed psychometric measures that assessed personality, problem-solving style, social desirability, and demographic variables. Concerning the psychometric properties of the IIPSS, I hypothesized that the IIPSS had a single factor structure, as seen in Study 1 and by Rubin et al. (2012). I also hypothesized that the construct validity of the IIPSS could be replicated. In addition, I tested whether social desirability was correlated with the IIPSS and whether controlling for social desirability would influence the interaction between openness and problem-solving style on neuroticism.

Method

Participants

Participants were 202 first year students enrolled in psychology undergraduate courses and research volunteers at an Australian university. Participants included 152 women and 38 men whose mean age was 23.39 ($SD = 7.96$) and who ranged from 18 to 61 years. Out of the 202 participants, 171 were Caucasian, 6 were Asian, 2 were Aboriginal, and 1 was African. Twelve participants did not indicate their ethnicity. All participants were recruited through the School of Psychology's Sona Research Participation System and were directed to the online study, which was hosted by the School of Psychology's LimeSurvey server. Student participants were awarded 1% course credit point for taking part in this study.

Ten participants did not reach the end of the survey and four participants declined their informed consent. Consequently, they were excluded from analyses. Two participants were excluded on the basis of very low variability in their response

patterns. One of these participants exclusively gave the responses *partially disagree* or *partially agree* to the questionnaire items. The other participant only gave the responses *partially agree* and *strongly agree* and indicated to have given untrue answers on the single-item measure on truthful responding (based on Meade & Craig, 2012). The sample size was 186 after these participant exclusions.

Procedure

Participants completed an online study titled “Working Styles”. Participants were informed in the Information Statement that the present study was examining different working styles, and that participants would be asked to respond to questions concerning their “characteristics and past behaviour in a number of situations.”

The current study consisted of several parts. In the beginning of the study, participants responded to measures of personality and problem-solving style. To prevent item-order effects, the scale items were presented in randomized order. Subsequently, participants described the scenario presented in one of two pictures that had previously been shown to prime affiliation and non-affiliation (Rubin, 2011b). Participants then worked on a series of alternative uses (creativity) tasks and time estimation tasks. Before working on each task, participants decided whether they wanted to see the responses of previous participants or not. Lastly, participants completed measures of social desirability, demand characteristics, and truthful responding, and they indicated their demographics. The median duration that participants took to complete the study was 28 minutes.

Measures

Problem-solving style, personality, demand characteristics, truthful responses. The measures used for problem-solving style, personality, demand characteristics, and useful responses were the same as those used in Study 1. Problem-

solving style was measured using the IIPSS, and the Big Five personality traits were measured using the BFI. Demand characteristics were measured using the PARH scale, and participants' truthful responding was measured using a single-item indicator based on Meade and Craig's (2012) recommendations. Please refer to Chapter 2 for a detailed presentation of these measures.

Social desirability. To investigate participants' tendencies to present themselves favourably, participants completed the impression management subscale of Version 6 of the Balanced Inventory of Desirable Responding scale (BIDR–6 Form 40; Paulhus, 1991). According to Lanyon and Carle (2007) and Stöber, Dette, and Musch (2002), the BIDR–6 Form 40 is the most widely used version of the BIDR. The BIDR–6 Form 40 consists of two subscales, impression management and self-deceptive enhancement. The former refers to intentional impression management, whereas the latter refers to unintentional self-deception (Paulhus, 1984). I only included the impression management subscale in the present research for the following reasons: First, discussions about social desirable responding in self-report data typically concern strategic response distortion as measured by the impression management subscale but not unintentional distortion as measured by the self-deceptive enhancement subscale (see Richman, Kiesler, Weisband, & Drawsgow, 1999). Second, Paulhus (1984) reported that the impression management subscale was more sensitive to biased responding and showed greater effect sizes than the self-deception enhancement subscale. According to Paulhus, “it is recommended that impression management, but not self-deception, be controlled in self-reports of personality” (p. 598). In line with Paulhus' recommendations, I included only the impression management subscale of the measure.

In previous investigations, the impression management subscale of the BIDR–6 Form 40 had satisfactory internal consistency ranging from .75 to .86 in student and adult samples and an acceptable test-retest reliability of .65 over a 5-week period (Paulhus, 1991). The impression management subscale had good convergent validities with deception and role playing scales and showed divergent validities with adjustment scales and the self-deception subscale of the BIDR–6 Form 40 (Paulhus, 1991; Paulhus & Reid, 1991).

There are two scoring methods currently in use for the BIDR–6 Form 40 (Stöber et al., 2002). Stöber et al. (2002) investigated the sensitivity of the dichotomous scoring method that Paulhus (1991) described compared to the continuous scoring method that has been frequently employed by other researchers (see Stöber et al., 2002). In continuous scoring, all answers on the response scale are counted to form a total score, whereas in dichotomous scoring, only extreme answers on the response scale are counted. Stöber et al. argued that dichotomous scoring would likely be less sensitive than continuous scoring in detecting socially desirable tendencies among participants who avoid extreme responses. Consequently, dichotomous scoring may be subject to extremity bias. Consistent with this possibility, Stöber et al. found that the continuous scoring procedure showed greater reliability and validity than the dichotomous scoring procedure. In the current study, participants responded to the impression management subscale of the BIDR–6 Form 40 on a 7-point response scale ranging from 1 (*not true*) to 7 (*very true*). Following Stöber et al., responses were scored using the continuous scoring method.

Demographics. Participants responded to standard demographic items such as age, gender, and nationality.

Results

Preliminary Analyses

Missing values. With the exception of demographic items, all responses were mandatory. A Little's (1988) Missing Completely at Random test was not statistically significant ($\chi^2 = 5.00$, $df = 8$, $p = .758$), indicating that there was no basis to assume that missing cases depended on key variables subject to analyses (see Little, 1988). Because the number of missing cases on age and gender was reasonably small and there was no indication that the missing cases were influencing any of the variables under the main research question, I decided to pairwise delete the missing cases.

Outliers. I noted cases that lay outside three standard deviations of the mean for each variable. Relating to Aim II, there was no multivariate outlier on problem-solving style and openness using Mahalanobis Distance with an alpha criterion of $p < .001$. However, there were two multivariate outliers on problem-solving style, openness, impression management, perceived awareness of the research hypotheses, age, and gender. I conducted each analysis with and without outliers in order to examine whether outlier exclusions impacted on the pattern of results.

Normality. All key variables showed sufficient convergence with the normal distribution curves, with the exception of age. The skewness and kurtosis values for age were outside the acceptable range of ± 2.0 . To make the age distribution more symmetric, I performed a log (base 10) transformation for age. The transformation achieved a normalisation for skewness but failed to correct positive kurtosis. Consequently, interpretations based on age need to be made with caution because kurtic variables affect statistical tests of variances and covariances (see DeCarlo, 1997).

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure. Following the procedures outlined in Study 1, I employed a

principal axis factor analysis with promax rotation on the IIPSS items (Russell, 2002; Widaman, 1993). The Kaiser-Meyer-Olkin value of .89 suggested that the sample was adequate to perform a factor analysis (Kaiser, 1974).

As shown in Figure 4.1, Cattell's (1966) scree plot showed that the eigenvalue slope tails off after the first factor and that the second factor remains in the elbow.

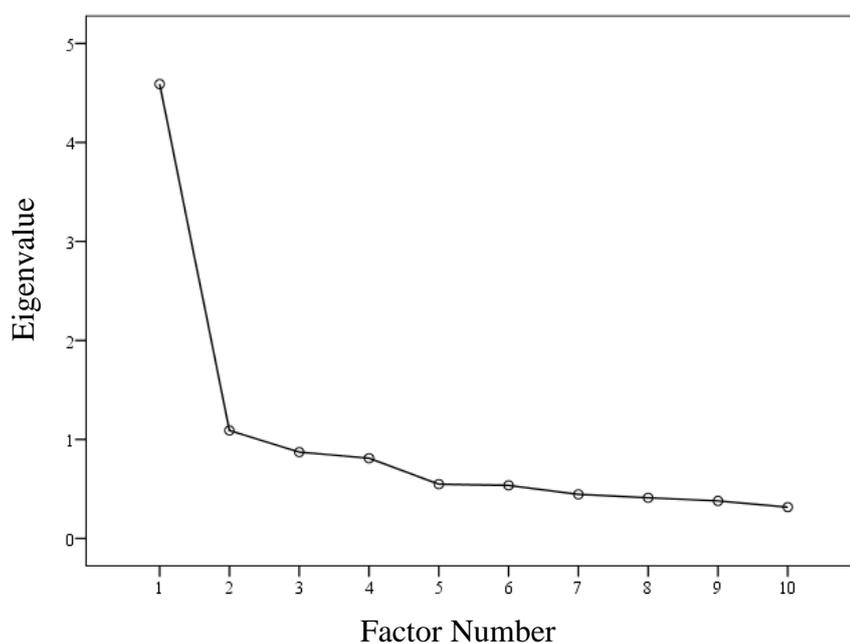


Figure 4.1. Cattell's scree plot for the IIPSS items.

I used parallel analysis (Horn, 1965) to determine whether the second factor in the elbow should be retained (see Wilson & Cooper, 2008). The parallel analysis with 100 random data sets, 10 variables, and 186 participants showed that the first factor but not the second factor exceeded the eigenvalues of the simulated data sets ($4.59 > 1.39$ & $1.09 < 1.27$, respectively). This result indicated that only one factor was present in the data. Consequently, I extracted one factor. As in Study 1, I employed the promax method of oblique rotation (see Fabrigar et al., 1999; Russell, 2002) and set the kappa value to 3 (see Tatarzyn et al., 1999).

Table 4.1 lists the item loadings of the single factor solution in the factor matrix. The factor accounted for 45.90% of the total variance and had an eigenvalue of 4.59. The factor loadings of all items exceeded the cut-of criteria of .30, ranging between .48 and .74. As in Study 1, the item “In general, I do not like to ask other people to help me to solve problems” obtained the largest item loading among the IIPSS items.

Descriptive statistics. Table 4.2 provides mean ratings, standard deviations, and alpha coefficients for problem-solving style, personality traits, social desirability, and perceived awareness of the research hypothesis. The Cronbach’s alpha coefficients ranged from .77 to .92, indicating acceptable internal consistency of the measures.

Correlations. Table 4.3 shows the Pearson correlations between key variables. Confirming the convergent validity of the IIPSS, problem-solving style had a weak to moderate negative correlation with agreeableness. This correlation suggested that interdependent problem-solvers were more agreeable than independent problem-solvers. In addition, problem-solving style showed a predicted negative correlation with extraversion but, contrary to expectations, the correlation did not yield statistical significance ($r = .10, n = 186, p = .168$). Confirming the divergent validity of the IIPSS and consistent with Study 1, problem-solving style showed no significant correlations with openness and conscientiousness. However, contrary to expectations and contrary to findings in Study 1, problem-solving style showed a weak positive correlation with neuroticism ($r = .16, n = 186, p = .029$), indicating that independent problem-solvers tended to be more neurotic.

Importantly, the IIPSS showed no significant correlation with social desirability ($r = -.02, n = 186, p = .784$). This null correlation suggested that participants’ responses to the IIPSS were not distorted by tendencies to respond in socially desirable ways (see King & Bruner, 2000).

Table 4.1

Item Loadings for the 10-item IIPSS Version 2

Item	Factor
1) In general, I do not like to ask other people to help me to solve problems.	.74
2) I like to get advice from my friends and family when deciding how to solve my personal problems.*	.73
3) I prefer to consult with others before making important decisions.*	.71
4) I would rather struggle through a personal problem by myself than discuss it with a friend.	.66
5) I usually find other people's advice to be the most helpful source of information for solving my problems.*	.65
6) I prefer to make decisions on my own, rather than with other people.	.64
7) I do not like to depend on other people to help me to solve my problems.	.58
8) I value other people's help and advice when making important decisions.*	.56
9) I usually prefer to ask other people for help rather than to try to solve problems on my own.*	.54
10) When faced with a difficult personal problem, it is better to decide yourself rather than to follow the advice of others.	.48

Note. Items with asterisk are reverse scored.

Table 4.2

Descriptive Statistics for Person-Based Variables, Impression Management, and Perceived Research Awareness

	Mean	SD	Alpha
IIPSS	3.85	.96	.87
Openness	4.73	.78	.77
Neuroticism	4.18	1.11	.88
Agreeableness	5.16	.79	.79
Extraversion	4.23	1.09	.87
Conscientiousness	4.45	.85	.82
IMBIDR	81.35	16.05	.79
PARH	3.71	1.32	.92

Note. All scales had a theoretical range of 1 to 7 apart from the impression management subscale (IMBIDR), which had a theoretical range of 20 to 140.

Table 4.3

Pearson Correlations Between Variables

Variables	1	2	3	4	5	6	7
1. IIPSS	—	—	—	—	—	—	—
2. Openness	.05	—	—	—	—	—	—
3. Neuroticism	.16*	-.19*	—	—	—	—	—
4. Agreeableness	-.21**	.22**	-.36**	—	—	—	—
5. Extraversion	-.10	.19**	-.38**	.18*	—	—	—
6. Conscientiousness	-.04	.10	-.32**	.36**	.17*	—	—
7. IMBIDR	-.02	.10	-.31**	.50**	-.08	.36**	—
8. PARH	.03	.12	-.20**	.18*	.14	.08	.12

Note. Two-tailed correlations * $p < .05$, ** $p < .001$, $N = 186$; IMBIDR = impression management subscale of the Balanced Inventory of Desirable Responding; PARH = Perceived Awareness of the Research Hypothesis

In relation to the second research aim, the nonsignificant correlation found between problem-solving and openness indicated that the two predictor variables measured different constructs (see Tabachnick & Fidell, 1989). In line with results obtained in Study 1, neuroticism showed a negative correlation with openness ($r = -.19$, $n = 186$, $p = .011$). This result indicated that higher levels of neuroticism were associated with lower levels of openness.

As seen in Study 1, neuroticism showed a significant negative correlation with demand characteristics. Participants who were less neurotic expressed higher awareness of the research hypothesis. I employed the more conservative criterion of +2.50 standard deviations above the mean to test whether some participants were more confident in the supposed research aims than the average participants. No participant reached this criterion, suggesting that all participants were generally unclear about what the study was supposed to investigate. Nonetheless, I included the PARH index as a

covariate in subsequent regression analyses in order to control for the effects of this influential variable.

In addition to problem-solving style, openness was not significantly correlated with social desirability. However, neuroticism showed a moderate negative association with social desirability, indicating that less neurotic participants were more prone to respond in socially desirable ways. Hence, following common recommendations (see King & Bruner, 2000), I also included social desirability as a covariate in subsequent regression analyses in order to test whether social desirability distorted the predicted moderating effect of openness on the relation between independent problem-solving and neuroticism.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Post hoc power analysis. I employed a post hoc power analysis to estimate whether the current sample size of 186 participants had sufficient power to detect the interaction effect between openness and problem-solving style on neuroticism. In Study 1, the moderated regression model yielded an overall effect size of $f^2 = .06$. Using G*Power Version 3.1.9 (Faul, Erdfelder, Buchner, & Lang, 2009), I performed a post hoc power analysis for a two-tailed multiple regression statistical test with the effect size of $f^2 = .06$, an alpha level of .05, a sample size of $N = 186$, and three predictor variables (i.e., openness, problem-solving style, & openness by problem-solving style interaction). Based on this analysis, the current sample had an adequate power value of .81 to detect the relations between openness, problem-solving style, and neuroticism.

I repeated the power analysis for the moderated multiple regression model considering age, gender, and perceived awareness of the research hypothesis as covariates. In Study 1, the model had an overall effect size of $f^2 = .12$ when age,

gender, and perceived awareness of the research hypothesis were added as statistical controls. I re-ran the post hoc power analysis with the corresponding effect size and six predictor variables. The estimation confirmed that the current sample had sufficient power (.96) to detect the relevant relations between the key variables with the addition of three covariates. In the current study, I also added a measure of impression management as a statistical control.

Moderating effect of openness. I examined the moderating effect of openness on the relation between problem-solving style and neuroticism using Model 1 of Hayes' (2013) PROCESS software. Openness and problem-solving style were mean centred prior to analysis. There was a significant effect of openness on neuroticism when problem-solving was at the sample mean, $b = -.26$, $SE = .10$, $t = -2.53$, $p = .012$, 95% CI [-.46, -.06], and a significant effect of problem-solving style on neuroticism when openness was at the sample mean, $b = .21$, $SE = .08$, $t = 2.53$, $p = .012$, 95% CI [.05, .37]. Consistent with Study 1, there was a significant interaction between problem-solving style and openness in predicting neuroticism, $b = -.22$, $SE = .11$, $t = -2.09$, $p = .038$, 95% CI [-.42, -.01], indicating that the effect of problem-solving style on neuroticism was linearly dependent on openness.

Figure 4.2 illustrates the conditional effects of problem-solving style on neuroticism at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. Consistent with findings in Study 1, at low levels of openness, independent problem-solving style had a significant positive effect on neuroticism, $b = .38$, $SE = .12$, $t = 3.16$, $p = .002$, 95% CI [.14, .61]. This result indicated that greater tendencies for independent problem-solving were associated with higher levels of reported neuroticism. In contrast to results in Study 1, at medium levels of openness, problem-solving style had also a significant positive effect on neuroticism, $b = .21$, $SE = .08$, $t =$

2.53, $p = .012$, 95% CI [.05, .37]. However, at high levels of openness, problem-solving style did not predict neuroticism, $b = .04$, $SE = .11$, $t = .35$, $p = .730$, 95% CI [-.18, .26].

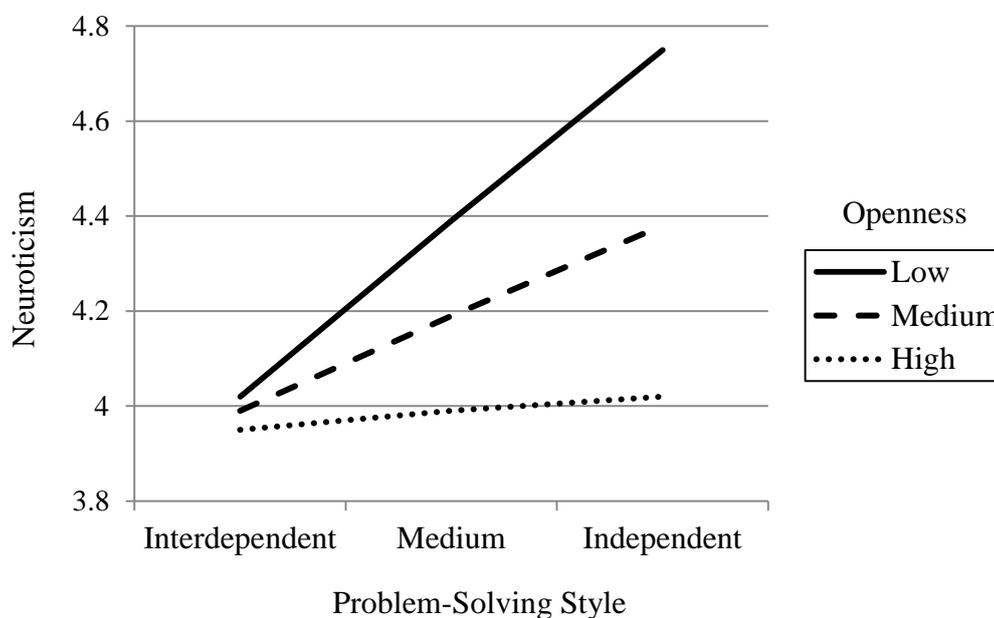


Figure 4.2. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness.

The pattern of results persisted with the exclusion of univariate and multivariate outliers and after adding impression management, age, and gender as controls. However, when the PARH scale measuring demand characteristics was added into the model, the interaction term only approached significance ($b = -.18$, $SE = .10$, $t = -1.85$, $p = .066$, 95% CI [-.37, .01]), indicating that demand characteristics substantially influenced the relation between openness and problem-solving style on neuroticism in the present study.

In summary, I found that openness moderated the relation between problem-solving style and neuroticism. Participants with an independent problem-solving style experienced more neuroticism when openness was low and medium, but especially when openness was low. At high levels of openness, problem-solving style did not

predict neuroticism. This pattern of results persisted after controlling for covariations with age, gender, and impression management but not perceived awareness of the research hypothesis.

Discussion

Aim I: Testing the Psychometric Properties of the IIPSS

Replicability of the psychometric properties of the IIPSS. My first aim was to investigate the replicability of the psychometric properties of the IIPSS. In line with Rubin et al. (2012) and findings from Study 1, a principal axis factor analysis showed that the IIPSS had a single factor structure and that the scale items had satisfactory internal consistency. Consistent with Study 1, the IIPSS showed a negative association with agreeableness and no significant associations with openness and conscientiousness. In addition, social desirability was unrelated to the IIPSS, supporting the validity of the IIPSS.

I also detected some differences between the current study and Study 1 and related previous findings (Cross et al., 2000; Rubin et al., 2012). Contrary to Study 1 and Rubin et al. (2012), the IIPSS did not significantly correlate with extraversion. Also contrary to Study 1, the IIPSS showed a small positive correlation with neuroticism. I expand on each of these findings below.

Factor structure. The factor structure of Version 1 of the IIPSS (Rubin et al., 2012) and Version 2 (Vieira, 2013) has been investigated in previous research. Rubin et al. (2012) found a single factor structure and Vieira (2013) found a two-factor structure for the IIPSS items. Vieira's findings may have been due to the relatively small sample size in his study ($N = 79$). According to a number of methodologists, conducting factor analyses in samples comprised of less than 100 participants are not recommended (Comrey & Lee, 1992; Gorsuch, 1983; Guadagnoli & Velicer 1988; Hatcher &

Stepanski, 1994; Hutcheson & Sofroniou, 1999; Kline 1994; Russell, 2002). Consistent with Study 1, Version 2 of the IIPSS yielded a single factor structure in the current study. This result was in line with the conceptual implication of a single factor structure, which implies that the IIPSS measures the *preference* for an independent or interdependent problem-solving style rather than the degree to which individuals are *both* (or not at all) independent *and* interdependent problem-solvers, as implicated by a two-dimensional model.

Internal consistency. The IIPSS had good internal consistency in previous research (Rubin et al., 2012; Vieira, 2013) and in Study 1. In the current study, the Cronbach's alpha of the IIPSS items ($\alpha = .87$) corresponded to the Cronbach's alpha found in Study 1 ($\alpha = .87$). In addition, the internal consistency of the IIPSS Version 2 in the current study was comparable to that of the IIPSS Version 1 ($\alpha = .81$; Rubin et al., 2012) and higher than the alpha reliabilities of Vieira's (2013) independent and interdependent factors of Version 2 ($\alpha = .77$ & $\alpha = .78$, respectively). Overall, results confirmed good internal consistency for Version 2 of the IIPSS.

Construct validity. I found mixed results regarding the construct validity of the IIPSS in the current study. Supporting the convergent validity of the measure, the IIPSS correlated negatively and significantly with agreeableness. Supporting the divergent validity of the measure, there was no significant correlation between the IIPSS and openness and conscientiousness. These results were consistent with findings in Study 1 and related findings on relational-interdependent self-construal and instrumental social support-seeking (Cross et al., 2000; Watson & Hubbard, 2006). However, there was one unexpected finding regarding the convergent validity of the IIPSS. In previous research, a preference for interdependence was associated with higher levels of extraversion (Cross et al., 2000; Rubin et al., 2012; Study 1). In the

current study, however, the IIPSS did not correlate significantly with extraversion. Although the trend was in the expected direction ($r = -.10$), the correlation coefficient was too weak to yield statistical significance. Also contrary to expectations, the IIPSS showed a significant positive correlation with neuroticism. This result was inconsistent with Study 1 and findings for relational-interdependent self-construal. However, I suspect that this correlation occurred due to the problem-solving aspect of the IIPSS. It is possible that this correlation reflects the risk of negative emotional outcomes when solving problems in a self-reliant fashion, as is argued in this thesis. Individuals who prefer to solve problems individually may encounter more stressful experiences in everyday problem-solving tasks which could manifest in a neurotic trait expression.

Social desirability. Social desirability is the most frequently investigated response bias in psychology (Paulhus, 1991). According to King and Bruner (2000), social desirability accounts for “one of the most common and pervasive sources of bias affecting the validity of experimental and survey research findings in psychology and the social sciences” (p. 80). Because the IIPSS included socially relevant information (e.g., on the importance of friends for solving problems), the IIPSS may be prone to response biases concerning favourable traits of friendship reciprocity and instrumental support (Hall, 2012).

In the current study, the IIPSS showed no significant correlation with socially desirable responding, as measured by the impression management subscale of the BIDR ($r = -.02$). This result was in line with Cross et al.’s (2012) findings. The authors found no significant correlation between the RISC scale and socially desirable responding. The null correlation between the IIPSS and social desirability provided further support for the discriminant validity of the IIPSS, indicating that the measure is not confounded with tendencies to respond in socially desirable ways (see King & Bruner, 2000;

Paulhus, 1991). Consequently, the findings concerning social desirability supported the overall validity of the IIPSS.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Replicability of the moderating effect of openness. The interaction between openness and problem-solving style on neuroticism was replicated in the current data set. When openness was low, an independent problem-solving style predicted higher levels of neuroticism. In contrast to Study 1, the conditional effect of independent problem-solving on neuroticism persisted at medium levels of openness, albeit less pronounced than when openness was low. At high levels of openness, problem-solving style did not predict neuroticism in the present analysis. This pattern of results persisted after controlling for social desirability (i.e., impression management), indicating that the moderating effect of openness could not be explained by tendencies to respond in socially desirable ways (see King & Bruner, 2000). In addition, age, gender, and the exclusion of outliers did not change the pattern of results. However, when perceived awareness of the research hypothesis was entered as a covariate, the interaction term became marginally significant ($p = .066$). This finding was in contrast to Study 1, and it is possible that it represents a Type II error.

As mentioned in the Introduction, the present study differed in a number of ways from the previous investigation. Differences in contextual factors included (a) the age distribution of participants, (b) the time period of completing the studies, (c) the position of the key measures within the studies (i.e., in the beginning of the study vs. randomized throughout the study), (d) the software platforms in which the surveys were presented, (e) the layout and design of the studies. The replicability of the interaction effect despite the changes in these contextual factors suggested that the effect could not

be explained by the aspects of the specific research situation mentioned above. Hence, observing the interaction effect in the light of these changes increases the confidence in the validity of the observed interaction effect.

According to Kerr (1998), post hoc observations must be interpreted with caution because they typically inflate the Type I error rate. Even with this limitation in mind, the current study showed that the interaction effect between openness and problem-solving style on neuroticism was less likely to be a chance finding because it was observed again in a second data set. As I mentioned in the Introduction, the probability that a significant effect is due to a Type I error reduces greatly in subsequent investigations because the alpha probabilities of the results multiply. In Study 1, the probability that the interaction effect was a Type I error was less than 1 in 1,000 due to an observed alpha level of $p < .001$. In the current study, the chance of obtaining a Type I error on a second occasion was reduced to $.001 \times .024 = .000024$, or 0.0024%, respectively. In other words, the chance of falsely rejecting the null hypothesis in the current study was less than 1 in 40,000. Because I tested the replicability of the interaction effect, the current analysis adhered to Popper's (1959) criterion of disconfirmability.

Limitations and Alternative Explanations

Limitations. Although the interaction between openness and problem-solving style on neuroticism replicated in the second data set, the effect may be limited to Australian student samples. The types of problems that students need to solve may be specific to the student population and do not generalize to other populations. For example, Schweitzer (1996) found that among Australian students, course concerns were the most common source of problems. Other student concerns were emotional problems, financial difficulties, career choice worries, and problems with lecturers

(Schweitzer, 1996). This distribution of concerns differed from surveys of the general population. For example, Lewinsohn and Talkington (1979) reported that common problems shared by a heterogenic citizen sample clustered around six broad domains, namely health and wellbeing, domestic inconveniences, partner or friendship problems, and legal and financial issues. With regards to personality differences, previous research found that the replicability of personality profiles was satisfactory in a student sample but not in a sample of the general population (Boehm, Asendorpf, & Avia, 2002) and that personality scale scores differed across professions (Tett et al., 2009). In addition, Schmitt, Allik, McCrae, and Benet-Martínez (2007) found that the Big Five personality structure was generally robust across 56 nations but that significant differences in levels of openness occurred across South American and East Asian regions. Taken together, these findings indicated that the results of the current study may be specific to (a) the student population and (b) the geographic region the study was conducted in. To test whether the interaction effect found in Study 1 and in the current study applied to a different sample, the third investigation discussed in Chapter 4 tested the replicability of the interaction effect in an international sample comprised of academic researchers.

Another limitation of the present research was that none of the explanations for the moderating effect of openness to experience were addressed in the current research. Murayama et al. (2014) recommended providing corroboratory evidence to prevent the inflation of Type I error rates. Specifically, the authors advised that “obtaining supportive evidence in follow-up analyses is unlikely if the first analysis revealed a significant effect only by chance” (p. 109). Therefore, I tested in the subsequent analysis whether there were indications of the self-efficacy and problem-solving ability

aspects of openness to experience that could provide additional support that the effect and the theoretical explanation were valid.

A further limitation of the current study was that the gender ratio was similar to that in Study 1, with approximately 70% female participants and 30% males. Although this gender composition was typical for gender distributions among psychology students (Cynkar, 2007) and for psychological research samples (Gosling, Vazire, Srivastava, & John, 2004), the generalizability of results was reduced. The subsequent sample had a higher male ratio because the study included a participant pool of research academics that typically comprise of more male academics relative to female academics (see European Commission, 2012).

Finally, some inconsistencies between Study 1 and the current study occurred regarding the conditional effect of problem-solving style on neuroticism at high levels of openness, and regarding the relation between problem-solving style and extraversion and openness. Hence, further tests were needed to (a) investigate the conditional relation between problem-solving style on negative emotionality, to (b) establish the construct validity of the IIPSS, and to (c) examine a possible gender difference in problem-solving styles.

Alternative explanations. An alternative explanation regarding the replicability of research findings was put forward by Makel et al. (2012). The authors reported that replication attempts of the same research team were significantly more likely to produce successful results than replication attempts by another research team. Makel et al. discussed two possible explanations for this outcome. The first explanation referred to the file-drawer effect (i.e., unsuccessful attempts do not get published). The second explanation referred to experimenter bias (i.e., the expectations of the researcher influence the results). I tried to rule out these concerns in the following ways:

Regarding the file-drawer effect explanation, I have included all of the studies that I conducted under my research protocol of the current thesis. As I stated previously, I did not report findings that were related to another research aim in my main text. However, a summary of computations related to my original Aim II, although not explicitly discussed, can be found in Appendix C. Regarding the experimenter bias explanation, none of the studies under the current research protocol involved contact with experimenters because the studies were administered online. Consequently, experimenter effects were avoided (see Reips, 2000).

A second alternative explanation is that the particular study design diminished the relation between problem-solving style and social desirability. The mode of administration has been shown to influence participants' tendencies to respond in a socially desirable way (Richman et al., 1999). A meta-analytic study comparing tendencies of socially desirable responding between computer-based questionnaires, paper-pencil questionnaires, and face-to-face interviews in psychology found that there was no substantial difference between computer-administered and paper-pencil questionnaires (Richman et al., 1999). However, when participants were alone (i.e., without an experimenter present) and could withdraw their responses, computer-based questionnaires elicited less social desirability than paper-pencil questionnaires. In addition, computer-based tests evoked significantly less distortion than face-to-face interviews. The current study met all those points shown to reduce social desirability. In particular, the current study employed an anonymous and computer-administered study design that allowed participants to work on the study from a computer of their choice (i.e., not in a lab and without an experimenter present). Participants could further withdraw from the study at any point without penalty. Thus, the influences of social desirability on the measures under the present research were likely minimised by

the particular study design. However, a null correlation between the IIPSS and social desirability could not be sufficiently explained by the specific study design because the present analysis was sensitive enough to detect some known overlapping between social desirability and the personality traits of agreeableness, conscientiousness, and neuroticism (Ones et al., 1996; Smith & Ellingson, 2002).

Implications

Some conclusions can be drawn from the present study that expand on the findings of the previous analysis presented in Chapter 3. First, the current study demonstrated the replicability of the psychometric properties of the second version of the IIPSS. In particular, the present study found a single factor structure, good internal consistency, and convergent and divergent validities with agreeableness and openness and conscientiousness. The association between the IIPSS and extraversion was in the expected direction but did not yield statistical significance.

Second, the current investigation expanded on previous investigations (Rubin et al., 2012; Vieira, 2013) by testing the influence of social desirability on participants' responses to problem-solving styles. Confirming the scale validity of the measure, the IIPSS showed a null correlation with socially desirable responding.

Third, the current study demonstrated the replicability of the moderating effect of openness to experience. Openness and problem-solving style interacted to predict neuroticism. This effect was robust against the potential influence of social desirability, age, and gender but was weakened when perceived awareness of the research hypothesis was entered as a covariate. Inspection of the PARH scores indicated, however, that participants were unclear about what the research was investigating. Hence, it was unlikely that demand characteristics biased the interaction effect in a

meaningful way. Overall, the replicability of the interaction effect suggests that the finding did not occur by chance alone.

**Chapter Five: Study 3. Replicability of the Moderating Effect of Openness
on the Relation between Independent Problem-Solving and Neuroticism among
Research Academics**

Introduction

Third Empirical Investigation

In the third empirical investigation, I tested the replicability of previous findings from Studies 1 and 2 in an international sample of research academics. As in the previous chapters, I reported the results as they related to my first and second research aim. To recap, the first research aim was to investigate the psychometric properties of the IIPSS, and the second aim was to investigate the moderating effect of openness to experience on the relation between problem-solving style and neuroticism.

Replication in a different sample. Based on Schmidt's (2009) explanations, replications in a different sample help to generalize research findings. In Studies 1 and 2, I reported results that related to Aims I and II. I tested the replicability of the research findings and found that the major relations detected in Study 1 were replicable in Study 2. However, both studies were conducted in student samples. Whereas several aspects of the psychometric properties of the IIPSS have been tested previously in different populations (Rubin et al., 2012; Vieira, 2013), it is possible that the interaction effect between openness and problem-solving style only holds in student samples. As I described in the previous chapter, the most common problems for students differ from the problems that are found among the general population (Lewinsohn & Talkington, 1979; Schweitzer, 1996). Because the IIPSS does not require participants to think of any specific kind of problem-solving situations, the problem-solving tasks that participants think of may vary considerably. Therefore, variations in the kinds of

problems that participants have in mind may alter responses to the IIPSS. Those differences in response patterns could then influence the observed interaction effect. As such, testing for the replicability of the interaction effect in a non-student sample would clarify whether the effect is applicable outside the student population.

Replicability of findings among academic researchers. I suspected that problem-solving style may be relevant among research academics. Like university students, research academics have relative freedom to choose how they approach their work-related tasks. In a meta-analysis on the motivational factors of research academics, Lechuga and Lechuga (2012) found that *autonomy* (e.g., choosing one's own work schedule) and *relatedness* (e.g., being part of a research community) were two central aspects of work motivation among academics who were employed at university faculties. Following Chiaburu and Harrison's (2008) meta-analytic findings, I considered the area of academic research in my current analysis because, in addition to personal problems, researchers were likely able to choose whether they preferred to solve work-related problems on their own or with the help of others.

Another reason for selecting a sample of academic researchers is that academia is largely an international discipline. Academics are usually approachable from anywhere in the world and are familiar with the English language. These aspects of academia allowed me to create a study in English that could be completed by academics in various countries. I chose a cross-national sample to investigate whether the replicability of the interaction effect was restricted to Australian samples or whether the interaction effect would generalize to an international sample.

A further aspect of academia is that the ratio between men and women differs from the gender ratio among university students. Women have remained underrepresented in academic positions in recent years (European Commission, 2012).

With more males holding academic positions, it was likely that the present sample would comprise of a different gender ratio than the student samples in Studies 1 and 2, in which about 80% females and 20% males participated. A different gender ratio would further my attempt to determine whether preferences in problem-solving styles differed between men and women.

Lastly, an academic sample would be substantially older than the student samples in Studies 1 and 2. As previously described, age has been shown to influence responses to personality scales (Roberts et al., 2006; Soto, John, Gosling, & Potter, 2011). For example, in a meta-analytical investigation on personality changes across the life span, Roberts et al. (2006) found that levels of openness increased in adolescence but decreased in middle age and older age. In addition, between the ages of 20 to 40 years, levels of neuroticism declined. Consequently, participants' responses to the neuroticism and openness items could change with older age and alter the interaction between openness and problem-solving style on neuroticism. Whereas the mean age difference between participants in Study 1 and 2 was only two years and did not seem to impact results, a sample comprised of older adults may indeed be influential. Overall, the present sample allowed for inspecting the scope of the interaction effect in older and professional adults of multiple nationalities.

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure of the IIPSS. Factor analyses in Studies 1 and 2 confirmed a single-factor structure for Version 2 of the IIPSS in two student samples. These results were consistent with an earlier inspection of the IIPSS (Rubin et al., 2012) but were in contrast to another investigation that obtained a two-factor structure (Vieira, 2013). The aim of the current study was to investigate the replicability of the single factor structure in a sample comprised of academic researchers.

Relation between problem-solving style and personality traits. Based on earlier research (Cross et al., 2000; Rubin et al., 2012), I expected weak to moderate negative correlations between the IIPSS and the social traits of extraversion and agreeableness. I also expected the IIPSS to show only very weak correlations with neuroticism and openness and conscientiousness. Study 1 supported these predictions, whereas Study 2 showed mixed results. In Study 2, the IIPSS showed an expected weak to moderate negative correlation with agreeableness but the correlation between the IIPSS and extraversion was not significant. In addition, while the IIPSS and openness and conscientiousness showed predicted nonsignificant correlations, the IIPSS and neuroticism showed a small but significant positive correlation. The current study aimed to further investigate the construct validity of the IIPSS in order to understand which of these results were unreliable anomalies and which were replicable.

Summary. In this third study, I tested the psychometric properties of the IIPSS similar to the previous studies. However, unlike the previous studies, the current study investigated the psychometric properties of the IIPSS in an international sample comprised of research academics. In particular, I tested whether the single factor structure obtained in Studies 1 and 2 and by Rubin et al. (2012) could be replicated. I also tested whether the IIPSS showed convergent validity with extraversion and agreeableness and divergent validity with openness and neuroticism.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

One limitation of the previous investigations is that none of the explanations for the moderating effect of openness to experience were addressed. According to Murayama et al. (2014), providing corroboratory evidence for presumed processes would reduce the possibility of Type I errors. In the current analysis, I tested the

veracity of the assumption that openness functions as a moderator variable because it is related to problem-solving self-appraisals. In the current study, I assessed this assumption in two ways.

First, I considered academics' single author ratio. Presumably, academics with a higher single-author ratio (i.e., more first-authored papers than multi-authored papers) would have greater practice and experience to publish in a self-sufficient manner than academics' with a lower single-author ratio. Therefore, academics who publish more single-authored than multi-authored papers would generally perceive their skills to publish papers independently as high. If openness encompassed appraisals on how effective individuals solved problems independently, then openness should be positively correlated with academics' single author ratio. Moreover, if openness was replaced with participants' single-author ratio in the analyses, then a preference for *interdependent* problem-solving should be related to greater levels in neuroticism when participants' single-author ratio is *high* (i.e., when participants highly appraised their independent publishing skills), and a preference for *independent* problem-solving should be related to greater levels in neuroticism when participants' single-author ratio is *low* (i.e., when participants poorly appraised their independent publishing skills).²

Second, I assessed academics' evaluation of their own research performance. Presumably, academics who rate their own research performance highly have higher occupational self-efficacy than researchers who rate their subjective performance less favourable. If openness encompasses academics' self-efficacy to perform well in their research, then openness should be positively correlated with academics' subjective

² As I explained in Chapter 1, Aim II was amended after the results for Studies 1, 2, 3, and 4 were known. Because these studies were already completed, I was unable to add specific measures of self-efficacy to Study 3. Therefore, I used existing measures of academics' ratio of single- versus multi-authored papers as a proxy for self-efficacy. By using single author ratio as a proxy for self-efficacy, I aimed to examine whether single author ratio could provide corroboratory evidence for the interaction between openness and problem-solving style on negative emotionality.

research performance ratings. Moreover, if openness is replaced with participants' subjective performance ratings in the analyses, then a preference for *interdependent* problem-solving should be related to greater levels in neuroticism when subjective performance is *high* (i.e., when participants had high self-efficacy in their research performance), and *independent* problem-solving should be related to greater levels in neuroticism when subjective performance is *low* (i.e., when participants had low self-efficacy in their research performance).

In summary, I tested whether aspects of the theoretical explanation I put forward in the matching hypothesis was corroborated using alternative measures. In particular, I assumed that positive appraisals of people's individual problem-solving ability would be related to openness to experience. I assumed that a match between problem-solving style (i.e., IIPSS) and problem-solving self-appraisal (i.e., openness) would be predictive of reduced reports of negative emotionality, whereas a mismatch between problem-solving style and appraisal would be predictive of relative increases in negative emotionality. If openness, single-author ratio, and subjective performance ratings measured aspects of the same problem-solving self-appraisal construct, then openness, single-author ratio, and subjective performance ratings should moderate the relation between problem-solving style and neuroticism.

Overview of Study 3

The current research study, as presented here, had two main aims: (a) to test the replicability of the psychometric properties of the IIPSS, and (b) to test the replicability of the moderating effect of openness on the relation between problem-solving style and neuroticism in a population comprised of academic researchers. In addition, I tested whether corroboratory evidence concerning the assumption that openness to experience was related to effective problem-solving self-appraisals could be identified.

In the present study, an international population comprised of academic researchers completed psychometric measures that assessed their personality, problem-solving, research performance indices, and demographic variables. Concerning the psychometric properties of the IIPSS, I hypothesized that the IIPSS had a single factor structure and that the IIPSS would show weak to moderate negative correlations with extraversion and agreeableness but only very weak correlations with openness and neuroticism. In addition, I tested whether openness was positively associated with participants' single-author ratio and subjective performance ratings. I further tested whether problem-solving style predicted neuroticism when (a) single author ratio was high and low and when (b) subjective performance ratings were high and low.

Method

Participants

Participants were 201 research academics employed at Australian and international universities. Participants included 63 women and 130 men whose mean age was 44.07 ($SD = 11.16$) and who ranged from 24 to 78 years. Participants' main research areas ranged from basic scientific fields such as chemistry, biology, physics, and mathematics through disciplines such as engineering, information technology, and mechanics to human sciences such as medicine, genetics, and social sciences. Out of the 201 participants, 123 were European, 23 were Asian, 17 were North American, 8 were Latin American and Caribbean, 4 were Middle Eastern and 3 were African. Participants could also indicate other ethnic backgrounds that were not listed. Seven participants indicated that they were Australian, 6 participants indicated that they were of mixed ethnicity, 1 participant indicated that they were English and another that they were Indian. Seven participants did not disclose their ethnicity.

Participants were recruited through one of four ways. First, I contacted Deans and Head of Schools of scientific faculties that were located at various national and international universities such as the Australian National University in Australia, Stanford University in the United States, and Utrecht University in the Netherlands. I asked the Faculty Deans or Head of Schools to send an e-mail to their academic staff that contained a participation request. Second, I contacted scientific societies such as the American Physical Society to distribute the participation request to their members. Third, I released participation requests on scientific internet platforms such as ResearchGate and Academia.edu. Fourth, I contacted researchers directly via the Thomson Reuters' "Web of Science" research platform. I searched for scientific papers in various areas (e.g., medicine, chemistry, & social sciences) and emailed authors who had published research articles since the year 2010 in English language. Researchers who took part in the present study were given the opportunity to enter a prize draw in which they had a 1 in 40 chance of winning a \$200 Amazon.com gift voucher.

A total of 422 academics accessed the Information Statement. Of these, 101 (24%) read the Information Statement but did not proceed to the study. Out of the 321 academics who proceeded to the study, 121 (29%) withdrew early. All of the remaining 200 participants (47%) completed the survey and provided their informed consent to include their responses in the analyses. One participant was excluded because she provided many repetitive responses that lacked the variability of genuine responses. For example, this participant exclusively gave the response *neutral* in one section and then exclusively gave the response *partially agree* in another section. In addition, this participant gave implausible responses to some items (e.g., research area of "tw") and indicated difficulties with the English language. The sample size was 199 after the participant exclusion.

Procedure

Participants completed an online study titled “Academic Working Styles and Performance.” Participants were informed in the Information Statement that the study was examining the “relation between academic working styles and performance among scientific researchers,” and that participants would be asked to respond to questions concerning their personal characteristics and journal article publications. Participants were eligible to participate if they had at least (a) one single-authored publication and (b) one multi-authored publication in which they were the main author.

The current study consisted of several parts. At the start of the study, participants responded to measures of personality, problem-solving style, support, and guidance. To prevent item-order effects, the scales were presented in a randomized order. Subsequently, participants gave performance indexes (i.e., eigenfactor & article influence scores) of their latest single- and multi-authored publications. Participants’ overall research performance was also assessed in terms of their *h* index and personal ratings of their own research performance. Lastly, participants indicated their demographics, including their main research area. Because participants were allowed to resume the study and work on the questionnaire in more than one sitting, I did not record the overall duration that participants took to complete the survey.

Measures

Except where indicated, all responses were made on a 7-point Likert-type scale anchored *strongly disagree* and *strongly agree*.

Problem-solving style and personality. The measures used for problem-solving style and personality were the same as those used in Studies 1 and 2. Problem-solving style was measured using the IIPSS, and the Big Five personality traits were

measured using the BFI. Please refer to Chapter 3 for a detailed descriptions of these measures.

Single author ratio and subjective performance ratings. To assess participants' ratio of single- versus multi-authored papers, participants responded to the self-generated item "Approximately, what percentage of your overall papers are you the first author?" by indicating a percentage value between 0% and 100%.

To investigate participants' evaluation of their research performance, participants responded to the self-generated item "How would you rate your own research performance?" on a scale ranging from 1 (*very poor*) to 8 (*outstanding*).

Demographics. Standard demographic items assessed participants' age, gender, and nationality. In addition, participants gave their main research area and indicated whether they experienced any difficulties completing the study in English language.

Results

Preliminary Analyses

Missing values. With the exception of demographic items, all responses were mandatory. A Little's (1988) Missing Completely at Random test was not statistically significant ($\chi^2 = 8.11$, $df = 17$, $p = .964$), indicating that there was no basis to assume that missing cases depended on key variables subject to analyses (see Little, 1988). Because the number of missing cases on age and gender was reasonably small and there was no indication that the missing cases were influencing any of the variables under the main research question, I decided to pairwise delete the missing cases.

Outliers. I noted cases that lay outside three standard deviations of the mean for each variable. Relating to Aim II, there was (a) one multivariate outlier on problem-solving style and openness using Mahalanobis Distance with an alpha criterion of $p < .001$. There were no multivariate outliers concerning (b) problem-solving style and

single-author ratio and (c) problem-solving style and subjective performance ratings. There were also no multivariate outliers with the addition of age and gender to each of the three sets of independent variables. I conducted each analysis with and without outliers in order to examine whether outlier exclusions impacted on the pattern of results.

Normality. All key variables showed sufficient convergence with the normal distribution curve. In addition, the skewness and kurtosis values for all key variables (including age) were within the acceptable range of ± 2.0 .

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure. Following the procedures outlined in Study 1, I employed a principal axis factor analysis with promax rotation on the IIPSS items (Russell, 2002; Widaman, 1993). The Kaiser-Meyer-Olkin value of .86 suggested that the sample was adequate to perform a factor analysis (Kaiser, 1974).

As shown in Figure 5.1, Cattell's (1966) scree plot showed that the eigenvalue slope tails off after the first factor and that the second factor remains in the elbow.

I used parallel analysis (Horn, 1965) to determine whether the second factor in the elbow should be retained (see Wilson & Cooper, 2008). The parallel analysis with 100 random data sets, 10 variables, and 199 participants showed that the first factor but not the second factor exceeded the eigenvalues of the simulated data sets ($4.26 > 1.36$ & $1.19 < 1.25$, respectively). This result indicated that only one factor was present in the data. Consequently, I extracted one factor. As in Study 1, I employed the promax method of oblique rotation (see Fabrigar et al., 1999; Russell, 2002) and set the kappa value to 3 (see Tataryn et al., 1999).

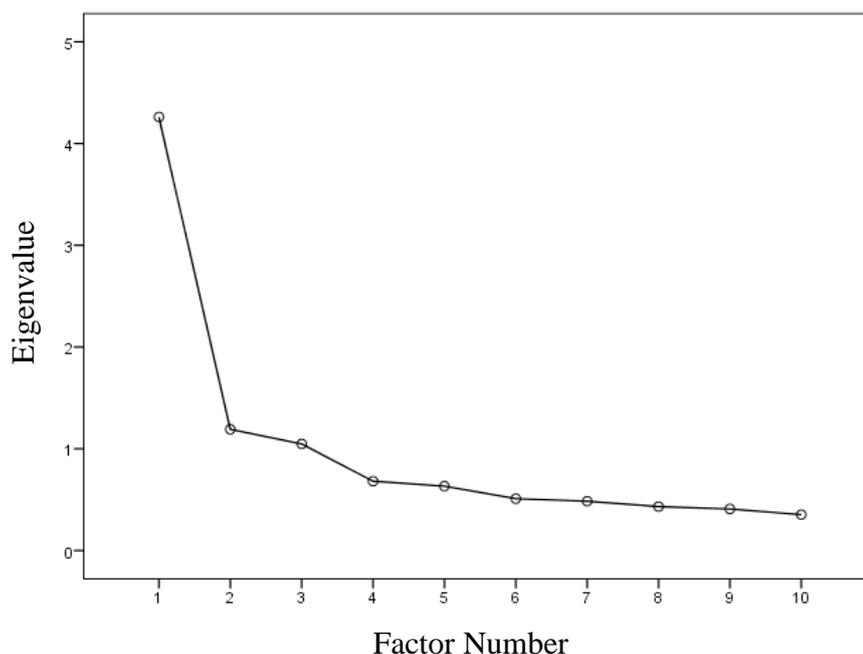


Figure 5.1. Cattell's scree plot for the IIPSS items.

Table 5.1 lists the item loadings of the single factor solution in the factor matrix. The factor accounted for 42.61% of the total variance and had an eigenvalue of 4.26. The factor loadings of all items exceeded the cut-off criteria of .30, ranging between .41 and .70. The item "I prefer to make decisions on my own, rather than with other people" obtained the largest item loading among the IIPSS items and describes independent problem-solving.

Descriptive statistics. Table 5.2 provides mean ratings, standard deviations, and alpha coefficients for independent-interdependent problem-solving, personality traits, single author ratio, and subjective performance ratings. The Cronbach's alpha coefficients ranged from .72 to .85, indicating acceptable internal consistency of the measures.

Correlations. Table 5.3 shows the Pearson correlations between key variables. Confirming the convergent validity of the IIPSS and in line with Studies 1 and 2, problem-solving style had a weak to moderate negative correlation with agreeableness.

Table 5.1

Item Loadings for the 10-item IIPSS Version 2

Item	Factor
1) I prefer to make decisions on my own, rather than with other people.	.70
2) I do not like to depend on other people to help me to solve my problems.	.67
3) In general, I do not like to ask other people to help me to solve problems.	.66
4) When faced with a difficult personal problem, it is better to decide yourself rather than to follow the advice of others.	.65
5) I prefer to consult with others before making important decisions.*	.62
6) I like to get advice from my friends and family when deciding how to solve my personal problems.*	.61
7) I would rather struggle through a personal problem by myself than discuss it with a friend.	.60
8) I usually find other people's advice to be the most helpful source of information for solving my problems.*	.56
9) I value other people's help and advice when making important decisions.*	.50
10) I usually prefer to ask other people for help rather than to try to solve problems on my own.*	.41

Note. Items with asterisks are reverse scored.

This correlation indicated that interdependent problem-solvers were more agreeable than independent problem-solvers. Also confirming the convergent validity of the IIPSS, problem-solving style showed a predicted weak to moderate negative correlation with extraversion, indicating that interdependent problem-solvers were more extraverted than independent problem-solvers. Confirming the divergent validity of the IIPSS, problem-solving style showed nonsignificant correlations with neuroticism and openness and conscientiousness in the current study.

Table 5.2

Descriptive Statistics for Person-Based Variables, Single Author Ratio, and Subjective Performance Ratings

	Mean	SD	Alpha
IIPSS	4.10	.99	.85
Openness	5.53	.67	.72
Neuroticism	3.53	1.06	.83
Agreeableness	5.15	.80	.74
Extraversion	4.53	1.02	.83
Conscientiousness	5.28	.91	.83
Single-Author Ratio	49.73	28.64	N/A
Subjective Performance Ratings	5.68	1.33	N/A

Note. N/A = not applicable. Most scales had a theoretical range of 1 to 7. Exceptions were the single author ratio variable, which had a theoretical range of 0 to 100 and participants' subjective performance ratings, which had a theoretical range of 1 to 8.

Table 5.3

Pearson Correlations Between Variables

Variables	1	2	3	4	5	6	7
1. IIPSS	—	—	—	—	—	—	—
2. Openness	.05	—	—	—	—	—	—
3. Neuroticism	.03	-.07	—	—	—	—	—
4. Agreeableness	-.23**	.14	-.45**	—	—	—	—
5. Extraversion	-.23**	.14*	-.26**	.15*	—	—	—
6. Conscientiousness	.04	.28**	-.30**	.34**	.25**	—	—
7. Single-Author Ratio	.01	.17*	-.05	-.04	.13	.00	—
8. Subj. Perf. Ratings	-.05	.23**	-.21**	.07	.11	.25**	.11

Note. Two-tailed correlations * $p < .05$, ** $p < .001$, $N = 199$

Relating to Aim II, the aforementioned nonsignificant correlation between problem-solving style and openness indicated that the two predictor variables were independent from another and did not measure the same construct (see Tabachnick & Fidell, 1989). Consistent with Studies 1 and 2, neuroticism showed a weak negative

correlation with openness. However, in contrast to Studies 1 and 2, this relation did not yield statistical significance in the current study ($r = -.07$, $n = 199$, $p = .302$).

Single-author ratio showed a significant positive relation with openness to experience. There were no significant correlations between single-author ratio and any other person-based variables. Participants' subjective academic performance ratings showed weak to moderate correlations with openness and conscientiousness. In addition, subjective performance ratings showed a weak to moderate negative correlation with neuroticism. These results indicated that participants' single-author ratios and participants' evaluations of their own research performance both increased with higher levels of openness. In addition, results indicated that participants' evaluations of their own research performance increased with higher levels of conscientiousness but decreased with higher levels of neuroticism.

Like openness, neither single-author ratio nor subjective performance ratings were significantly related to participants' problem-solving styles, indicating that these variables were unrelated to preferences to solve problems independently or with the help of others and, therefore, did not measure the same construct as the IIPSS (see Tabachnick & Fidell, 1989). I presented findings of the regression analyses in the subsequent section.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Post hoc power analysis. I employed a post hoc power analysis to estimate whether the current sample size of 199 participants had sufficient power to detect the interaction effect between openness and problem-solving style on neuroticism. In Study 1, the moderated regression model yielded an overall effect size of $f^2 = .06$. In Study 2, the moderated regression model yielded an overall effect size of $f^2 = .09$. Using

G*Power Version 3.1.9 (Faul et al., 2009), I performed a post hoc power analysis for a two-tailed multiple regression statistical test with the smaller of the two effect sizes of $f^2 = .06$, an alpha level of .05, a sample size of $N = 199$, and three predictor variables (i.e., openness, problem-solving style, & openness by problem-solving style interaction). Based on this analysis, the current sample had an adequate power value of .84 to detect the relations between openness, problem-solving style, and neuroticism.

I repeated the power analysis for a version of the moderated multiple regression model that included age and gender as covariates. In Study 1, the model had an overall effect size of $f^2 = .13$ when age and gender were added as statistical controls. In Study 2, the model had an overall effect size of $f^2 = .17$ when age and gender were added as statistical controls. I re-ran the post hoc power analysis with the smaller of the two effect sizes of $f^2 = .13$ and five predictor variables. The estimation confirmed that the current sample had sufficient power (.98) to detect the relevant relations between the key variables with the addition of two covariates.

Moderating effect of openness. I examined the moderating effect of openness on the relation between problem-solving style and neuroticism using Model 1 of Hayes' (2013) PROCESS software. Openness and problem-solving style were mean centred prior to analysis. There was no significant effect of openness on neuroticism when problem-solving was at the sample mean, $b = -.09$, $SE = .11$, $t = -0.81$, $p = .419$, 95% CI $[-.32, .13]$, and no significant effect of problem-solving style on neuroticism when openness was at the sample mean, $b = .04$, $SE = .08$, $t = 0.47$, $p = .637$, 95% CI $[-.11, .19]$. In contrast to Studies 1 and 2, the interaction between problem-solving style and openness in predicting neuroticism only approached significance, $b = -.18$, $SE = .11$, $t = -1.67$, $p = .097$, 95% CI $[-.39, -.03]$. Nonetheless, given the previous results that were obtained in Studies 1 and 2, I proceeded to decompose this interaction effect.

Figure 5.2 illustrates the conditional effects of problem-solving style on neuroticism at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. At low levels of openness, independent problem-solving style had a positive effect on neuroticism. This effect was significant in Studies 1 and 2. However, in the current study, the effect only approached significance, $b = .16$, $SE = .11$, $t = 1.46$, $p = .147$, 95% CI $[-.06, .37]$. At medium and high levels of openness, the effect sizes were smaller and p values were completely nonsignificant ($b = .04$, $SE = .08$, $t = 0.47$, $p = .637$, 95% CI $[-.11, .19]$ & $b = -.08$, $SE = .10$, $t = -0.82$, $p = .415$, 95% CI $[-.29, .12]$, respectively).

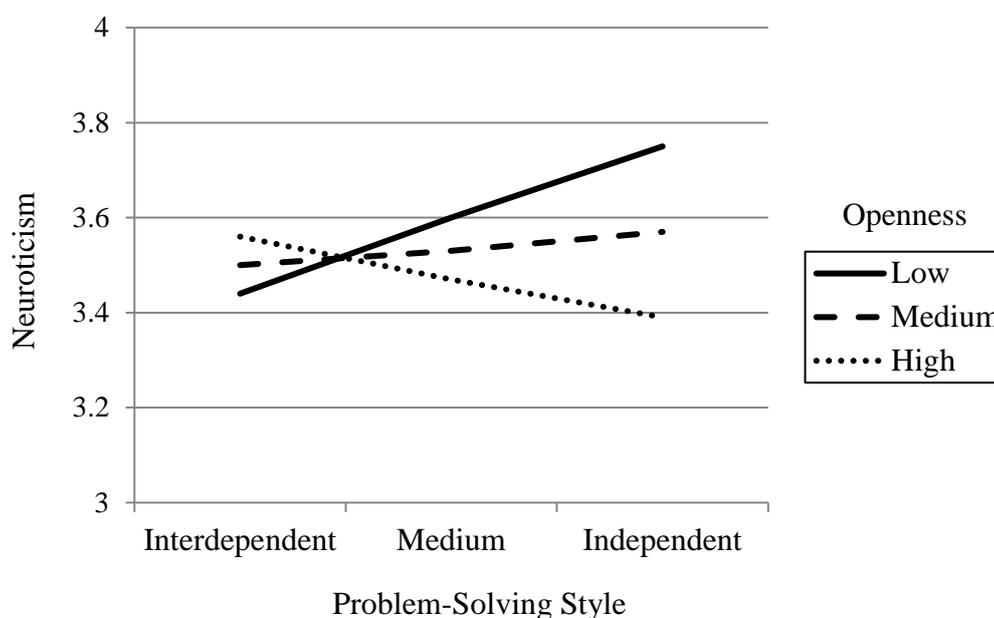


Figure 5.2. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness.

After exclusion of one univariate and one multivariate outlier, the pattern of results persisted. The interaction term approached significance ($p = .062$). The conditional effect of problem-solving style on neuroticism approached significance only at low levels of openness ($p = .10$) but not at medium ($p = .58$) or high levels of

openness ($p = .37$). This pattern of results further persisted after controlling for age and gender.

The moderating effects of single author ratio and subjective performance ratings in predicting negative emotions. To examine whether single-author ratio moderated the relation between problem-solving style and neuroticism, I computed another regression analysis. Single-author ratio and problem-solving style were mean centred prior to analysis. There was no significant effect of single-author ratio on neuroticism when problem-solving was at the sample mean, $b = -.00$, $SE = .00$, $t = -0.69$, $p = .494$, 95% CI [-.01, .00], and no significant effect of problem-solving style on neuroticism when single-author ratio was at the sample mean, $b = .06$, $SE = .08$, $t = 0.77$, $p = .444$, 95% CI [-.09, .21]. However, the interaction between problem-solving style and single-author ratio in predicting neuroticism was significant, $b = -.01$, $SE = .00$, $t = -2.37$, $p = .019$, 95% CI [-.01, -.00].

Figure 5.3 illustrates the conditional effects of problem-solving style on neuroticism at low ($-1 SD$), medium (M), and high ($+1 SD$) values of participants' single-author ratio. At low percentages of single-authored papers, independent problem-solving style had a significant positive effect on neuroticism, $b = .24$, $SE = .12$, $t = 2.05$, $p = .042$, 95% CI [.01, .47]. At medium and high percentages of single-authored papers, problem-solving style did not predict neuroticism ($b = .06$, $SE = .08$, $t = 0.77$, $p = .444$, 95% CI [-.09, .21] & $b = -.12$, $SE = .10$, $t = -1.25$, $p = .213$, 95% CI [-.32, .07], respectively). The pattern of results persisted with the exclusion of outliers and after adding age and gender as controls. I also tested to see whether participants' research area influenced the results. Although research area was a significant covariate ($p = .047$), the pattern of results remained significant.

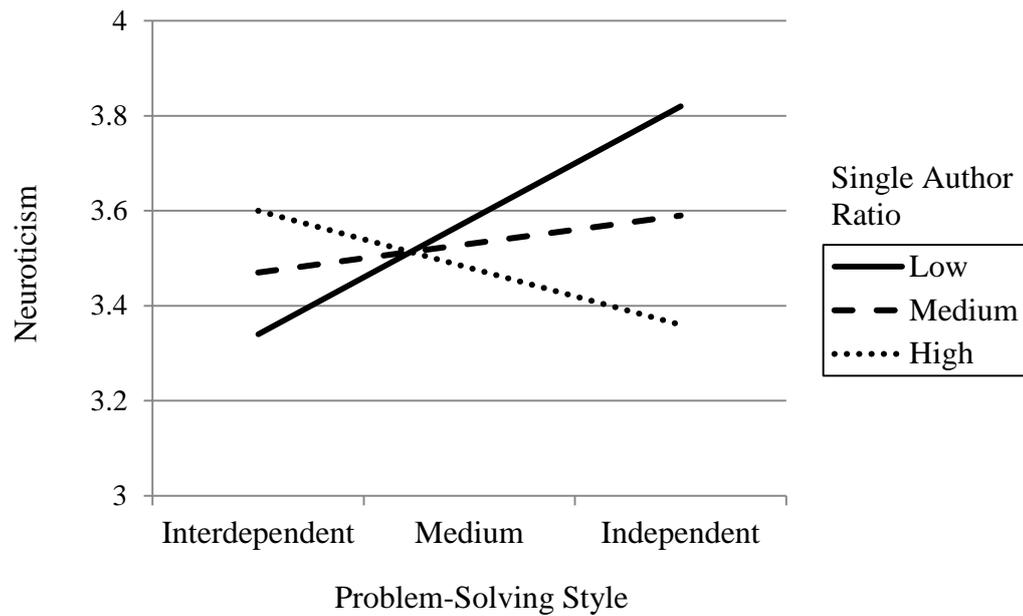


Figure 5.3. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high percentages ($+1 SD$) of single-authored publications.

Lastly, I examined whether participants' subjective research performance ratings moderated the relation between problem-solving style and neuroticism. Subjective performance ratings and problem-solving style were mean centred prior to analysis. There was a conditional effect of subjective performance ratings on neuroticism when problem-solving was at the sample mean, $b = -.14$, $SE = .06$, $t = -2.47$, $p = .015$, 95% CI $[-.25, -.03]$, but no significant effect of problem-solving style on neuroticism when problem-solving was at the sample mean, $b = -.14$, $SE = .06$, $t = -2.47$, $p = .015$, 95% CI $[-.25, -.03]$, but no significant effect of problem-solving style on neuroticism when subjective performance ratings were at the sample mean, $b = .02$, $SE = .07$, $t = 0.30$, $p = .764$, 95% CI $[-.12, .17]$. The interaction between problem-solving style and subjective performance ratings in predicting neuroticism was significant, $b = -.17$, $SE = .06$, $t = -2.77$, $p = .006$, 95% CI $[-.29, -.05]$.

Figure 5.4 illustrates the conditional effects of problem-solving style on neuroticism at low ($-1 SD$), medium (M), and high ($+1 SD$) values of participants' own research performance ratings. At low levels of subjective performance, independent problem-solving style had a significant positive effect on neuroticism, $b = .25$, $SE = .11$, $t = 2.21$, $p = .028$, 95% CI [.03, .47]. At medium levels of subjective performance, problem-solving style did not predict neuroticism, $b = .02$, $SE = .07$, $t = -1.87$, $p = .062$, 95% CI [-.41, .01]. At high levels of subjective performance, the negative effect of problem-solving style on neuroticism approached significance, $b = -.20$, $SE = .11$, $t = -1.88$, $p = .062$, 95% CI [-.41, .01]. The pattern of results persisted with the exclusion of outliers and after adding age and gender as controls.

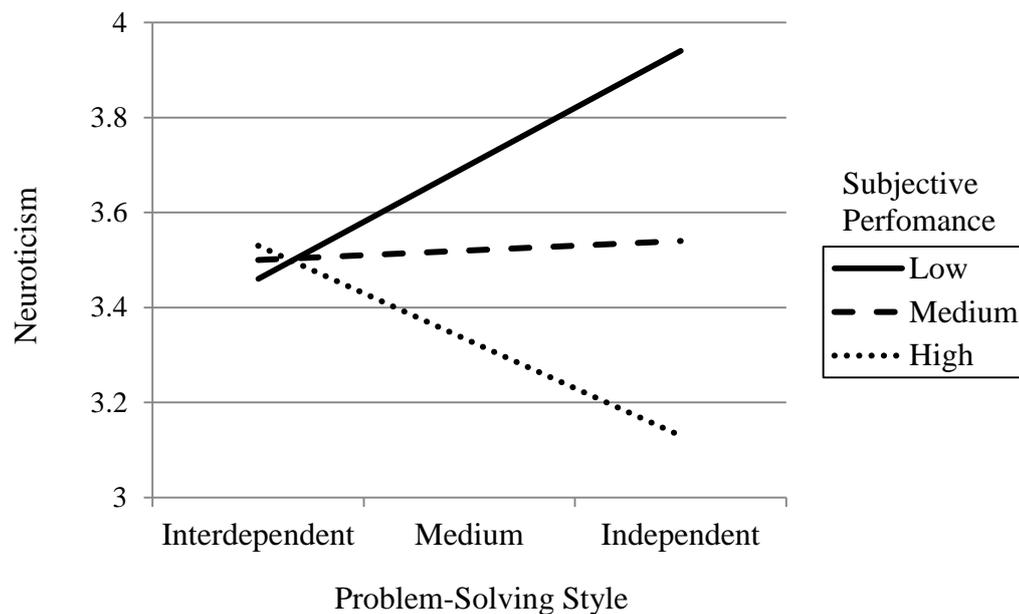


Figure 5.4. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of subjective performance ratings.

In summary, I found that the moderating effect of openness on the relation between problem-solving style and neuroticism approached significance in a sample

comprised of research academics. The trend in the current study suggested that academics with an independent problem-solving style experienced more neuroticism when openness was low. At medium and high levels of openness, problem-solving style did not predict neuroticism. This pattern of results persisted after controlling for univariate and multivariate outliers and after controlling for covariations with age and gender.

Further, the current regression analyses suggested that similar patterns emerged when openness was replaced with participants' ratio of single-authored publications as well as subjective research performance ratings. The percentage of participants' single-authored publications and their research performance ratings interacted with participants' problem-solving styles to predict neuroticism. In particular, when single-author ratio or self-rated performance was low, independent problem-solving predicted greater levels of participants' neuroticism. In addition, when self-rated performance was high, the effect turned around in that independent problem-solving marginally predicted *lower* levels of neuroticism.

Discussion

Aim I: Testing the Psychometric Properties of the IIPSS

Replicability of the psychometric properties of the IIPSS. My first aim was to investigate the replicability of the psychometric properties of the IIPSS in a sample comprised of research academics. In line with previous findings by Rubin et al. (2012) and findings from Studies 1 and 2, a principal axis factor analysis showed that the IIPSS had a single factor structure and that the scale items had satisfactory internal consistency. In line with predictions, the IIPSS showed predicted negative associations with agreeableness and extraversion as well as no significant association with openness and neuroticism and conscientiousness.

Factor structure. Consistent with Studies 1 and 2, Version 2 of the IIPSS yielded a single factor structure in the current study. This result implies that the IIPSS measures the *preference* for an independent *or* interdependent problem-solving style rather than the degree to which individuals are independent *and* interdependent problem-solvers, as implicated by a two-dimensional model.

The results also indicated that the single factor structure was replicable across different populations with the exception of Vieira's (2013) investigation, which yielded a two-factor structure amongst 79 business graduate students. Rubin et al. (2012) obtained a single factor structure in a sample comprised of Australian immigrants. Studies 1 and 2 yielded a single factor structure in undergraduate student samples. The current study adds to these findings in that it detected a single factor structure in a novel sample comprised of international research academics.

Internal consistency. The IIPSS had good internal consistency in previous research (Rubin et al., 2012; Vieira, 2013). In the current study, the Cronbach's alpha of the IIPSS items ($\alpha = .85$) were similar the Cronbach's alpha found in Studies 1 and 2 (both $\alpha s = .87$). The internal consistency of the IIPSS Version 2 in the current study was comparable to that of the IIPSS Version 1 ($\alpha = .81$; Rubin et al., 2012) and higher than the alpha reliabilities of Vieira's (2013) independent and interdependent factors of Version 2 ($\alpha = .77$ & $\alpha = .78$, respectively). Overall, results confirmed good internal consistency for Version 2 of the IIPSS in a novel sample comprised of academic researchers.

Construct validity. Supporting the convergent validity of the measure, the IIPSS correlated negatively and significantly with agreeableness and extraversion. Supporting the divergent validity of the measure, there was no significant correlation between the IIPSS and openness and neuroticism and conscientiousness. These results were

consistent with findings in Study 1 and related findings on relational-interdependent self-construal (Cross et al., 2000). Overall, the findings of the current study indicated that the predicted relations between the IIPSS and Big Five personality traits were replicable in a sample population comprised of academic researchers.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Replicability of the moderating effect of openness among academic researchers. The interaction between openness and problem-solving style on neuroticism was only approaching significance in the current analysis. The conditional effect at low levels of openness resembled findings in Studies 1 and 2. In particular, when openness was low, an independent problem-solving style was associated with higher levels of neuroticism. However, this relation only approached significance. The conditional effect of independent problem-solving on neuroticism was nonsignificant at medium levels of openness. Contrary to expectations, but in line with findings in Study 2, the conditional effects of independent problem-solving on neuroticism was nonsignificant at high levels of openness. This pattern of results persisted after controlling for age, gender, and the exclusion of outliers.

In contrast to the student samples in Studies 1 and 2, the current study employed a sample comprised of research academics. Therefore, the current study tested the generalizability of the moderating effect of openness (see Schmidt, 2009). Key differences between the student samples and the academic researcher sample included (a) the occupation of participants, (b) the age and gender distribution of participants, (c) the time period of completing the studies, (d) the recruitment methods, and potentially, (e) the situations participants were imagining when responding to the IIPSS items. The

interaction effect only approached statistical significance in the current study. Hence, one or more of these factors could have contributed to the weakening of the effect.

The current study constituted the third empirical investigation in which I detected the interaction effect between problem-solving style and openness on neuroticism, although the interaction only approached significance in the present study. The recurrence of the effect suggested that the results did not occur by chance alone. As I mentioned in the previous chapter, the probability that a significant effect is due to a Type I error reduces greatly in subsequent investigations because the alpha probabilities of the results multiply. In Study 1, the probability that the interaction effect was a Type I error was less than 1 in 1,000 due to an observed alpha level of $p < .001$. In Study 2, the chance of obtaining a Type I error on a second occasion was reduced to $p < .000024$. Based on the p values of Study 1 ($p < .001$) and Study 2 ($p = .024$), the chances of obtaining a Type I error on a third occasion ($p = .097$) was $.001 \times .024 \times .097 = .000002328$, or 0.0002328%, respectively. In other words, the chance of falsely rejecting the null hypothesis in the current study was less than 1 in 400,000. As Study 2, the current analysis adhered to Popper's (1959) criterion of disconfirmability because it tested the replicability of the interaction effect. In summary, although the pattern of results only approached significance in the present study, results generally suggested that the moderating effect of openness was replicable among academic researchers.

Corroboratory evidence for the ability and self-efficacy aspects of openness.

In the current study, I explored whether there were any corroboratory findings for the interaction effect of problem-solving style and openness to experience on neuroticism. According to Murayama et al. (2014), it would be unlikely to find supportive evidence if an effect occurred by chance alone. In the present study, I examined the percentages

of participants' single-authored publications compared to their multi-authored publications and I examined how participants' rated their own research performance.

In Chapter 2, I argued that openness encompasses aspects of cognitive engagement, functional problem-solving approaches, and self-efficacy. In the present study, single-author ratio and subjective performance ratings showed significant correlations with openness. As I explained in the Introduction, an academic's single-author ratio presumably reflects problem-solving self-appraisals in publishing papers independently and an academic's self-rating of their research performance presumably reflects their overall self-efficacy in relation to personal research activities. I tested whether the proclaimed aspects of personal problem-solving appraisal also interacted with problem-solving style to predict neuroticism. Significant results suggested that when (a) single-author ratio and (b) subjective performance ratings were low, independent problem-solving positively predicted neuroticism. In other words, when academics had little experience in publishing articles independently, their preference to work on their own was positively related to negative emotionality. Likewise, when academics were of the opinion that their research lacked quality, their preference to work on their own was positively related to negative emotionality. In addition, at high levels of subjective performance ratings, the effect turned around in that independent problem-solving marginally and negatively predicted neuroticism. Therefore, when academics were of the opinion that they produced high quality research, their preference to work with others tended to be negatively related to negative emotionality. Contrary to predictions, there was no significant relation between problem-solving style and neuroticism at high percentages of single-authored publications. Despite this nonsignificant finding, the results were largely in line with the assumption that openness interacted with problem-solving style because openness is related to problem-solving

self-appraisals. Among research academics, those facets of perceived individual problem-solving ability could be described in terms of academics' experience in publishing single-authored papers and their self-rated research performance evaluations.

Limitations and Alternative Explanations

Limitations. There are several limitations to be noted in regards to the present research study. Limitations concern (a) the construct validity of the IIPSS in regards to Aim I, (b) unexplored reliability and validity aspects of the IIPSS, and (c) corroboratory evidence in relation to the scope of the effect in regards to Aim II.

Concerning the psychometric properties of the IIPSS, the construct validity showed predicted convergent validities with extraversion and agreeableness and divergent validities with openness and neuroticism. However, this account of construct validity is rather limited. For example, the IIPSS is likely to show convergent validities with Cross et al.'s (2000) RISC scale because of the similarities in the theoretical conceptualisations of both scales. Further, I noted in Chapter 2 that the IIPSS relates to help-seeking measures in that the IIPSS and help-seeking scales assess people's tendencies to be interdependent. Thus, it would be useful to assess the convergent validity of the IIPSS in regards to relational-interdependent self-construal and help-seeking measures in order to expand on the construct validity of the IIPSS.

A psychometric property that was not addressed in the current study and in the previous studies was the test-retest reliability of the IIPSS. The test-retest reliability addresses the stability of participants' responses to the IIPSS over time. So far, the IIPSS was only administered at a single time point in the previous samples. To determine the consistency of the measure over time, future research should examine whether the IIPSS shows adequate test-retest reliability.

Another important aspect that was not addressed in the current study and in the previous studies was the relation between participants' responses to IIPSS items and their actual problem-solving behaviour. Rubin et al. (2012) found that the IIPSS was positively related to participants' intentions to search the internet to find a solution to a problem (i.e., independent problem-solving) and negatively related to participants' intentions to ask a friend to find a solution to a problem (i.e., interdependent problem-solving). However, future research should further investigate the criterion-related validity of the IIPSS. For example, it would be useful to investigate how strongly responses to the IIPSS items relate to actual help-seeking behaviours in the week prior to completing the measure.

One limitation regarding the corroborate findings in regards to Aim II is that participants' single-author ratio and subjective performance ratings were single-item measures. Single-item measures have been described as being of limited reliability (e.g., Loo, 2002), although other evaluations did not support the inferiority of single-item measures in psychology (Gardner, Cummings, Dunham, & Pierce, 1998, Wanous & Hudy, 2001; Wanous, Reichers, & Hounis, 1997). Despite employing single-item measures, the moderating effects of single-author ratio and subjective performance ratings yielded more pronounced effects than the moderating effect of openness, which employed only multi-item measures. Theoretical considerations may account for this outcome. It is possible that the self-efficacy aspects describe the underlying mechanisms better than the broader trait measure of openness. It would be useful to test this aspect further in order to arrive at a theoretical explanation that describes the boundaries of the interaction effect more concisely. I addressed this issue in Study 5.

An additional limitation related to participants' single-author ratio is that I did not distinguish between the kinds of multi-authored papers that academics produced.

Consequently, it remained unclear under which circumstances authors published multi-authored papers (e.g., as part of an international collaboration with other leaders in the field or as part of a doctoral thesis within one institution). My main intention was to contrast authors who published alone from authors who collaborated in any way with other authors. In particular, I assumed that authors who published alone would generally perceive their skills to publish papers independently as high. Because the study is already completed and participants took part in the online survey on an anonymous basis, I have no way in obtaining additional information on multi-authored papers retrospectively.

Another limitation of the present investigation is that the replicability of the interaction effect was not tested using alternative measures for problem-solving style and negative emotionality. Investigating the replicability of the interaction effect using related measures would clarify whether or not the effect is restricted to the IIPSS and neuroticism. For example, measures that encompass aspects of independent or interdependent problem-solving should be suitable to replace the IIPSS in the interaction term. Similarly, I argued in Chapter 1 that neuroticism is a chronic trait expression of negative emotionality such as stress and anxiety. A way of testing the reliability of the moderating effect of openness would be to test whether the interaction between openness and problem-solving style also predicts stress and anxiety. These claims are addressed in my subsequent studies.

Alternative explanations. I argued that the moderating effect of openness was present in the current study even though this effect only approached significance. An alternative explanation for the findings is that the interaction effect in fact did not exist in the present sample. According to this alternative explanation, the study showed that the interaction effect occurred among students but not among academic researchers. As

mentioned in the previous chapter, students indeed have been shown to deal with problems that are unique to their circumstances (Schweitzer, 1996). Consequently, the moderating effect of openness may only be descriptive of the kinds of problems that mostly concern the student population. However, the pattern of results was consistent with Studies 1 and 2, specifically in that conditional effects showed that independent problem-solvers were more neurotic when they were low in openness. I find it more likely that the interaction effect is generalizable to academic researchers but that the effect may be more pronounced in student samples. I interpret the current trends of results as a demonstration of the replicability of the moderating effect of openness. This interpretation is based on theoretical considerations raised in this chapter and the low statistical likelihood that the effect occurred due to a Type I error.

Implications

Some conclusions can be drawn from the present study that expand on the findings of previous analyses presented in Chapters 3 and 4. First, the current study demonstrated the replicability of the psychometric properties of the second version of the IIPSS in a novel sample population. In particular, the present study found a single factor structure, good internal consistency, and convergent and divergent validities with personality traits in the expected directions. Overall, the present study provided further evidence that the IIPSS is a valid and reliable psychometric tool for young and older adults who are students and academics and who live in Australian and overseas.

Second, the trend of the moderating effect of openness was replicated in the current data set. These results suggest that the moderating effect of openness is unlikely to be restricted to student samples. Rather, the effect seems to be generalizable to research academics.

Third, the current study was the first to demonstrate corroboratory evidence that provided some additional information concerning the theoretical underpinnings of the moderating effect of openness. Results showed that academics' experience in publishing single-authored papers and greater confidence in their personal research performance reduced the negative effects of independent problem-solving on negative emotionality. These results were in line with the assumption that self-efficacy appraisals would reduce the relation between independent problem-solving style and negative emotionality.

Chapter Six: Study 4. The Replicability of the Moderating Effect of Openness using Alternative Measures for Problem-solving Style and Negative Emotionality

Introduction

Fourth Empirical Investigation

In this fourth empirical investigation, I tested the replicability of previous findings from Studies 1 to 3 and addressed several limitations discussed in the previous chapter. Concerning the psychometric properties of the IIPSS, I sought to provide a more comprehensive investigation of the convergent and divergent validity of the measure. I also examined the test-retest reliability of the IIPSS and the criterion-validity regarding participants' recent problem-solving behaviours prior to the examination. Concerning the moderating effect of openness, I examined whether alternative measures for problem-solving style and negative emotionality could be employed to produce the interaction effect. I further aimed to investigate whether state-based measures of negative emotionality mediated the interactive effect of openness and problem-solving style on neuroticism.

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure of the IIPSS. Factor analyses in Studies 1, 2 and 3 confirmed a single-factor structure for Version 2 of the IIPSS. While these results confirmed previous findings regarding Version 1 (Rubin et al., 2012), the results were in contrast to an earlier inspection of Version 2 that obtained a two-factor structure (Vieira, 2013). In line with the implications of a unidimensional model, I argued that the IIPSS would measure how problems are being approached, either in an independent or an interdependent manner. In a two-dimensional model, however, the IIPSS would

additionally capture the extent to which problems are both addressed independently and interdependently or avoided all together. In the present investigation, I continued to examine the underlying factor structure of the IIPSS.

Relation between problem-solving style and self-construal and help-seeking. In my previous studies, I demonstrated some evidence on the convergent and divergent validity of the IIPSS. However, some key issues have still to be addressed. As mentioned in Chapter 1, problem-solving style is conceptually related to relational-interdependent self-construal. Therefore, the IIPSS should show convergent validity with Cross et al.'s (2000) RISC scale. Specifically, the IIPSS should be negatively correlated with the RISC scale because the IIPSS is coded in a way that higher scores indicate a preference for independent problem-solving and the RISC scale is coded in a way that lower scores indicate independent self-construal. According to Rubin (2011c), independent self-views facilitate an independent problem-solving style. Previous investigations by Rubin et al. (2012) supported this reasoning. In the pilot test of the first version of the IIPSS, the IIPSS correlated significantly and negatively with the RISC scale ($r = -.34$). In the current study, I aimed to test whether this finding could be replicated using the most recent second version of the IIPSS.

In addition to self-construal, the IIPSS encompasses relational problem-solving behaviour. There are several scales that measure the relational aspect of problem-solving. For example, the Assessment of Achievement Related and Help Seeking Tendencies scale (Karabenick & Knapp, 1991) measures students' formal and informal help-seeking tendencies and achievement-related behaviours. I expected that students' formal and informal help-seeking behaviours would be negatively correlated with the IIPSS. Similarly, I expected that other help-seeking scales would be negatively correlated with the IIPSS, including (a) the Decision-Making Collaboration Scale

(Anderson et al., 1998), (b) the General Help-Seeking Questionnaire (Wilson et al., 2005), (c) the Social Provisions Scale (Cutrona & Russell, 1987), (d) the Multidimensional Scale of Perceived Social Support (Zimet et al., 1988), (e) Achievement Related and Help Seeking tendencies, (f) Help-seeking Scales (Karabenick, 2003), and (g) the seeking social support subscale of the revised Ways of Coping scale (Folkman et al., 1986). All these scales have in common that they assess people's tendencies to solicit others during problem-solving. It is important to conduct these tests to provide further validation of the IIPSS.

Relation between problem-solving style and problem-solving avoidance.

The current study included a measure of escape-avoidance coping, namely the Escape-Avoidance subscale of the Ways of Coping scale (Folkman et al., 1986). The escape-avoidance items capture the degree to which people tend to withdraw themselves from a problematic situation. For example, the item "wished that the situation would go away or somehow be over with" implies that a problematic situation is being identified but (preferably) not actively addressed. It will be important to investigate whether the IIPSS is significantly related to problem-solving avoidance. If the IIPSS were uncorrelated with problem-solving avoidance, then this would indicate that the IIPSS measures independent-interdependent problem-solving. However, if the IIPSS were significantly associated with problem-solving avoidance, then this would indicate that the IIPSS was confounded with problem-solving avoidance. The latter case would be problematic because it would suggest that the IIPSS measures more than independent-interdependent problem-solving.

Relations between problem-solving style and social desirability and demand characteristics and self-esteem. In my previous investigations, I examined the relations between the IIPSS and impression management and perceived awareness of

the research hypothesis. Measures of social desirability and demand characteristics are generally used to test whether scale responses are confounded with participants' response bias (King & Bruner, 2000; Mortel, 2008; Rubin, 2010, para1). In Studies 1 and 2, I included the PARH scale (Rubin et al., 2010) as a measure of demand characteristics and in Study 2, I included the impression management subscale of the BIDR-6 Form 40 (Paulhus, 1991) as a measure of social desirability to control for possible response bias effects. While problem-solving style was not related to social desirability in Study 2, this relation should be tested again in the present study due to differences in scale presentations. While only measures of personality and problem-solving style were assessed in Study 2, the present study employed a large number of psychometric scales that also included help-seeking and decision-making scales and measures of help-seeking threat and self-esteem. In addition, the personality and problem-solving style measures were presented at the start of Study 2. In the present study, however, the presentation order of measures was randomized and, as a consequence, the IIPSS would have been presented on average half-way through the study. Participants' behaviours would have been assessed in preceding psychometric measures that implied common social standards of reciprocity, instrumental aid, and self-worth (Chai, Wu, & Brown, 2009; Hall, 2012; Heine, Lehman, Markus, & Kitayama, 1999), which could have facilitated socially desirable responding throughout the study and could also affect responses to the IIPSS.

The IIPSS was uncorrelated with perceived awareness of the research hypothesis in Study 2. In Study 1, however, the IIPSS showed a small negative correlation with perceived awareness of the research hypothesis, indicating that interdependent problem-solvers felt more aware of the research aims than independent problem-solvers.

According to Orne and Whitehouse (2000), demand characteristics are "the totality of

cues and mutual expectations which inhere in a social context... which serve to influence the behaviour and/or self-reported experience of the research receiver” (p. 469). Interdependent problem-solvers may be more sensible to the social context of the research situation and thus may be more inclined to “help” researchers than independent problem-solvers. In Study 1, the overall research context in which the study was embedded was more obvious compared to the current study. Study 1 was titled “Starting University” and participants read in the information statement that the study was “examining the effect of starting university on students’ lives.” In addition, participants were informed that only first-year students were eligible to participate in the study and that participants would be asked for their permission to have their end of year results inspected. Overall, the information statement of the research provided considerable cues that students’ integration into university would be assessed. It is possible that demand characteristics may have been enhanced in interdependent problem-solvers in the light of a more explicit “research story”. The current study, however, does not provide such an extensive context. The current study was titled “Personality and Handling Situations” and participants read in the information statement that the study was “examining personality and how it influences behaviour in different situations,” which did not provide a specific context compared to Study 1 and thus may have been more vague. Further, all participants read in the information statement that their consent was sought to link the present study to Study 1 if they had previously completed Study 1. This inquiry could have made it less clear what the research was truly aiming to investigate, hence reducing the effects of demand characteristics.

To further establish the divergent validity of the IIPSS, I also sought to investigate the relation between problem-solving style and self-esteem. Generally, self-

esteem describes the evaluation of one's self-worth (Blascovich & Tomaka, 1991). Research conducted in the area of relational-interdependent self-construal found that self-construal was unrelated to global self-esteem, as measured by Rosenberg's (1965) Self-Esteem Scale (Cross et al., 2000; Cross, Morris, & Gore, 2002). Because problem-solving style is conceptually based on relational-interdependent self-construal (Rubin, 2011c), evidence from research based on self-construal theory suggested that the IIPSS would be unrelated to global self-esteem.

In the present study, I included measures of social desirability, demand characteristics, and self-esteem to examine the divergent validity of the IIPSS. Specifically, I examined whether the reliability of the null correlation between the IIPSS and impression management found in Study 2 in light of the differences in study designs. I also tested whether the negative correlation between the IIPSS and perceived awareness of the research hypothesis found in Study 1 would replicate in the present investigation that gave a less specific study context. Finally, following previous research on relational-interdependent self-construal, I examined whether problem-solving style would be unrelated to participants' self-esteem.

Relation between problem-solving style and personality traits. Based on earlier research (Cross et al., 2000; Rubin et al., 2012), I expected weak to moderate negative correlations between the IIPSS and the social traits of extraversion and agreeableness. Studies 1, 2, and 3 generally supported these predictions. An exception occurred in Study 2, in which the IIPSS showed an expected negative correlation with extraversion ($r = -.10$) but the correlation did not yield statistical significance. In addition, based on Cross et al.'s (2000) examination concerning relational-interdependent self-construal and personality traits, I further expected that the IIPSS was only very weakly and not significantly correlated with neuroticism and openness to

experience. Based on Watson and Hubbard's (2006) findings concerning instrumental social support-seeking, I also suggested that the IIPSS was only very weakly and not significantly correlated with conscientiousness. Again, results from Studies 1, 2, and 3 were largely consistent with these predictions. However, the IIPSS and neuroticism showed a small but significant positive correlation in Study 2 ($r = .16$). The current study aimed to further investigate the construct validity of the IIPSS in order to determine how robust the expected results would be across multiple investigations.

Criterion-related validity of the IIPSS. In the present study, I also aimed to further establish the criterion-related validity of the IIPSS. Criterion-related validity refers to the degree to which a measurement tool corresponds to an external criterion, such as comparing scores of a science aptitude test with students' grades in a science course (Peng & Mueller, 2004). In other words, criterion-related validity testing estimates "the credibility of inferences to be made from test scores or measurements" (Peng & Mueller, 2004, p. 214) and is therefore a relevant part of validity testing. In a previous examination, Rubin et al. (2012) tested the predictive validity of the IIPSS. The authors found that the IIPSS was positively related to participants' intentions to search the internet to find a solution to a problem ($r = .13$) and negatively related to participants' intentions to ask a friend to find a solution to a problem ($r = -.31$). These results confirmed expectations in that independent problem-solvers preferred self-sufficient problem-solving strategies and interdependent problem-solvers preferred problem-solving strategies that involved getting help from others. In the present study, I examined whether responses to the IIPSS corresponded to individuals' self-reported actual behaviours in problem-solving situations that had occurred in the seven days prior to completing the study. In this way, I tested the retrospective criterion validity of the IIPSS.

Test-retest reliability of the IIPSS. Another way in which the current study expanded on the previous investigations was that it examined the test-retest reliability of the IIPSS. The degree to which results of the same examinees can be reproduced across two different time points using the same measurement tool constitutes an important indicator of a measure's reliability (Allen & Yen, 1974). As Downing (2004) discussed, low test-retest reliability outcomes prevent meaningful interpretations of test scores and thus lower the validity evidence provided by the test. Cross et al. (2000) demonstrated the stability of the RISC scale over two one-month periods ($r_s = .74$ & $.76$, respectively) and two two-month periods ($r_s = .67$ & $.63$, respectively). Because problem-solving styles are thought to be influenced by stable individual differences in relational and independent self-views (Cross et al., 2000; Rubin, 2011c), the IIPSS is conceptualized as a relatively stable preference for independent or interdependent problem-solving. Therefore, participants' responses to the IIPSS across two points in time should remain relatively consistent. Some variations in students' problem-solving styles may be expected because students may adapt their problem-solving preferences as they progress through their studies. For example, students may adjust their problem-solving behaviours relative to the opportunities that universities provide for either independent problem-solving, such as online database searches, or interdependent problem-solving, such as study groups. However, when multiple problem-solving options are present, students should likely prefer strategies that complement their problem-solving styles. Thus, I expected responses to the IIPSS items to be fairly consistent among undergraduate students. In particular, I investigated the test-retest reliability of IIPSS scores of participants who responded to IIPSS items in Study 1 and in the present study. Adequate test-retest reliability would confirm the consistency of IIPSS scores across time.

Summary. In this fourth study, I tested the psychometric properties of the IIPSS similar to the previous studies. However, unlike the previous studies, I expanded on previous considerations in that I tested the construct validity using additional scales that measure aspects of help-seeking, coping, and self-esteem. I also investigated the test-retest reliability of student participants who had completed both Study 1 and the current study.

Similar to the previous investigations, I examined whether the single factor structure obtained in Studies 1 to 3 and by Rubin et al. (2012) could be replicated. I also tested whether the IIPSS showed convergent validity with extraversion and agreeableness and divergent validity with openness, neuroticism, conscientiousness and escape-avoidance coping. I also tested whether the null correlations between the IIPSS and impression management and perceived awareness of the research hypotheses found in Study 2 could be replicated.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

In the current study, I examined whether the interaction effect would hold when alternative measures for (1) problem-solving style and (2) negative emotionality were employed. Replicating the interaction effect with similar but not identical measures would demonstrate that the effect is not restricted to specific measures. Therefore, testing whether the interaction effect could be replicated with similar measures for problem-solving style and neuroticism provided additional information concerning the reliability of the moderating effect of openness.

Alternative measures of problem-solving style. I examined whether scales that measure aspects of interdependent problem-solving predicted neuroticism at low levels of openness in the same way that the IIPSS did. In particular, I was interested

whether the seeking social support subscale of the revised Ways of Coping scale (Folkman & Lazarus, 1985) and the RISC scale (Cross et al., 2000) could replace the IIPSS to yield the moderating effect of openness. I assumed that seeking social support would be related to interdependent problem-solving. The conceptual similarity between these two scales is apparent in their constituent items. For example, the seeking social support item “I asked a relative or friend I respected for advice” resembles the interdependent problem-solving item “I like to get advice from my friends and family when deciding how to solve my personal problems.” The seeking social support subscale does not explicitly assess independent problem-solving. All items of the social support subscale refer to interpersonal coping and problem-solving. However, relating to the unidimensional explanation of the IIPSS, I assumed that independent problem-solvers would score lower on the social support subscale than interdependent problem-solvers. Therefore, I expected that the seeking social support subscale would be suitable to measure the construct of independent or interdependent problem-solving orientation.

Because the RISC scale and the IIPSS are conceptually related (see Rubin, 2011c), some overlap should occur because of the common underlying construct of self-construal. For example, the social orientation described in the RISC item “When I think of myself, I often think of my close friends or family also” resembles the social orientation described in the IIPSS item “I like to get advice from my friends and family when deciding how to solve my personal problems.” However, in addition to the self-construal aspect, the IIPSS items also describe a problem-solving context that is not captured by the RISC scale. Consequently, I expected that the overall interaction effect between relational-interdependent self-construal and openness to be less pronounced because the RISC scale does not encompass problem-solving situations.

Alternative measures of negative emotionality. I also examined whether depression, anxiety, and stress were influenced by the interactive effect of openness and problem-solving style. In my previous investigations, I employed the trait measure of neuroticism as an outcome measure of negative emotionality. As described in Chapter 2, neuroticism has been previously characterised as trait anxiety and chronic feelings of distress (e.g., Bouchard, 2003) and has been described as a marker of negative affective states such as stress, anxiety, and depression (see Lovibond & Lovibond, 1995). Moreover, neuroticism, depression, anxiety, and stress have been shown to influence each other and to overlap considerably, partially due to shared modes of formation (e.g., Gatt et al., 2009; Lahey, 2009). For example, Gatt et al. (2009) showed that among a non-clinical sample of 374 Europeans, genetic vulnerability and early life stress interacted to predict higher levels of neuroticism, depression and anxiety in later life. To examine whether the moderating effect of openness predicted the negative emotions of depression, anxiety, and stress, I employed the short version of the Depression, Anxiety, and Stress Scale (DASS 21; Lovibond & Lovibond, 1995). The DASS 21 measures the severity of negative emotional states over the past week. The inclusion of the scale was useful because the DASS 21 employed three core negative emotions in a more state-based fashion than the neuroticism variable. This allowed me to investigate whether the moderating effect of openness also predicted more state-based feelings of negative emotions.

The inclusion of the DASS 21 further allowed me to investigate whether negative emotional states were accountable for the long-term expression of neuroticism. I employed a mediated moderation model to examine whether depression, anxiety and stress could explain the interactive effect of problem-solving style and openness on neuroticism. In particular, an independent problem-solving style should affect state-

level experiences of depression, anxiety, and stress in individuals who are low in openness, and an interdependent problem-solving style should affect state-level experiences of depression, anxiety, and stress in individuals who are high in openness. These state-level elevations in depression, anxiety, and stress should then contribute to a longer-term neurotic trait expression. This process would result (a) in the observations reported in Studies 1 to 3, showing that independent problem-solving affected neuroticism when openness was low, and (b) in the observation reported in Study 1, showing that interdependent problem-solving affected neuroticism when openness was high.

The influence of impression management. In Chapter 3, I explained that the tendency to give socially desirable responses may influence the moderating effect of openness on the relation between problem-solving style and neuroticism because social orientation (i.e., agreeableness) was found to be positively associated with social desirability (e.g., Ones et al., 1996). Hence, interdependent problem-solvers may underreport their true levels of negative emotionality because they perceive that it is not favourable to express negative emotions. This could lead to the false assumption that independent problem-solvers experience greater negative emotionality than interdependent problem-solvers. Contrary to this explanation, the interactive effect of openness and problem-solving style on neuroticism remained unaffected when impression management was controlled in Study 2. This finding suggested that the elevated levels of neuroticism reported by independent problem-solvers who were low in openness were unlikely to be due to response biases. In the present study, I tested the replicability of this important finding. In addition, the current study addressed more so than Study 2 negative emotional feelings. Negative moods have been shown to be perceived as socially unacceptable and have led to underreporting, especially among

individuals with chronically elevated levels of anxiety and negative moods (Campbell-Sills, Barlow, Brown, & Hofmann, 2006). Thus, social desirability may have been more influential in the current study because participants were questioned on their negative emotionality in greater depth than in Study 2.

Overview of Study 4

In the present study, student participants completed psychometric measures that assessed their personality, problem-solving, help-seeking and coping styles, negative emotionality, and demographic variables. Concerning the psychometric properties of the IIPSS, I hypothesized that the IIPSS had a single factor structure, adequate test-retest reliability, and acceptable criterion-related validity. I also hypothesized that the IIPSS would show expected correlations with help-seeking scales and the traits of agreeableness and extraversion as well as null correlations with escape-avoidance tendencies, self-esteem, impression management, perceived awareness of the research hypothesis, and the traits of neuroticism, openness, and conscientiousness.

Concerning the moderating effect of openness, I tested whether openness interacted with (a) participants' tendencies to seek social support and (b) relational-interdependent self-construal to predict neuroticism. I further tested whether independent problem-solving predicted depression, anxiety, and stress when openness was low, and whether interdependent problem-solving predicted depression, anxiety, and stress when openness was high. I also examined whether the moderating effect openness was mediated by participants' state-based levels of negative emotions and whether social desirability influenced the moderating effect of openness in the present study.

Method

Participants

Participants were 349 undergraduate students enrolled in a psychology undergraduate course and three student research volunteers at an Australian university. Participants included 289 women and 63 men whose mean age was 22.20 ($SD = 6.29$) and who ranged from 18 to 61 years. Out of the 352 participants, 307 were Caucasian, 10 were Aboriginal, 7 were Asian, 1 was African, and 1 was Torres Strait Islander. Twenty-two participants indicated that they held ethnicities other than the ones mentioned, and four participants declined to indicate their ethnicity. All participants were recruited through the School of Psychology's Sona System software. Psychology undergraduate students were awarded 2% course credit points for taking part in this study.

Eight participants declined their informed consent and were consequently excluded from analyses. Based on Meade and Craig's (2012) recommendations for conducting online surveys, participants responded to a single-item measure of truthful responding and a single-item measure that tested whether participants paid attention to the item content. In response to these items, five participants declared that they had given untrue answers and failed to respond correctly to the paying attention item. These participants were excluded from analyses on that basis. In addition, two participants were among the bottom 1% of participants to complete the study in less than 12 minutes and did not respond correctly to the paying attention item. Consequently, they were also excluded from analyses. The sample size was 337 after these participant exclusions.

Procedure

Participants completed an online study titled “Personality and Handling Situations.” In the Information Statement, participants were informed that the study was “examining personality and how it influences behaviour in different situations.” Participants were informed prior to commencing the study that they would be asked to respond to a series of statements that indicated aspects of participants’ personality, their behaviour in different situations, and their relationships to other people. Participants were also informed that they would be asked to respond to questions regarding their demographics and social class.

Participants completed a battery of 23 psychometric scales. To prevent presentation-order effects, these scales were presented in randomized order, except for items relating to social desirability, demand characteristics, truthful responding, demographics and social class, which were positioned at the end of the questionnaire. I included scales that measured participants’ personalities, problem-solving styles, and help-seeking and coping styles. I also assessed participants’ self-esteem, self-construal, negative emotionality, and problem-solving behaviours in the past week. Finally, participants were asked questions regarding social desirability, demand characteristics, truthful responding, demographics, and social status. The median duration that participants took to complete the study was 36 minutes.

Measures

Except where indicated, all responses were made on a 7-point Likert-type scale anchored *strongly disagree* and *strongly agree*.

Problem-solving style, social desirability, demand characteristics, and truthful responses. The measures used for problem-solving style, social desirability, demand characteristics, and truthful responses were the same as those used in my

previous studies. Problem-solving style was measured using the IIPSS, and social desirability was measured using the impression management subscale of the BIDR-6 Form 40. Demand characteristics were measured using the PARH scale, and participants' truthful responding was measured using a single-item indicator based on Meade and Craig's (2012) recommendations. Please refer to Chapters 3 and 4 for a more detailed presentation of these measures.

Personality traits. The Big Five personality traits were assessed using the 10-item short version of the Big Five Inventory (BFI-10; Rammstedt & John, 2007). Like the full version, the BFI-10 measures the personality traits of openness to experience, neuroticism, agreeableness, extraversion, and conscientiousness. Each dimension is measured with two items that best represent the original dimensions of the 44-item BFI. For example, the two items for neuroticism are "I see myself as someone who gets nervous easily," and the reverse-worded item "I see myself as someone who is relaxed, handles stress well." The abbreviated scale was shown to capture 70% of the variance of the full BFI and to retain 85% of the test-retest reliability of the full BFI across several samples (Rammstedt & John, 2007). According to Rammstedt and John (2007), the structural validity between the BFI and BFI-10 were substantial. Factor analysis showed that the 10 items loaded on the predicted five factors with mean loadings of $r = .64$, which was comparable to the full version of the BFI ($r = .63$). Because the short version of the BFI has been shown to have adequate psychometric properties, I chose to administer the BFI-10 to reduce the likelihood of participant fatigue given the large amount of psychometric scales employed in the present study.

Self-construal. Relational-interdependent self-construal was assessed using the RISC scale (Cross et al., 2000). An example item for interdependent self-construal is "In general, my close relationships are an important part of my self-image" and an

example item for independent self-construal is “My close relationships are unimportant to my sense of what kind of person I am.” Cross et al. (2000) found that the RISC scale had good convergent and divergent validity as well as good reliability across eight American student samples. As mentioned in Chapter 1, the RISC scale showed expected positive correlations with the social personality dimensions of agreeableness ($r = .35$) and extraversion ($r = .28$), as measured by the NEO Five-Factor Inventory (Costa & McCrae, 1992). The RISC scale did not significantly correlate with the emotional trait of neuroticism ($r = .08$) and the cognitive trait of openness ($r = .09$). Cross et al.’s further examination of the scale’s construct validity revealed that the RISC scale correlated significantly and positively with related measures such as the Interdependent Self-Construal Scale ($r = .41$; Singelis, 1994) and the Communal Orientation scale ($r = .41$; Clark, Ouellette, Powell, & Milberg, 1987) but was uncorrelated to the Marlowe-Crowne Social Desirability scale ($r = .05$; Crowne & Marlowe, 1960), indicating that the responses were not influenced by tendencies to respond in socially favourable ways. The authors reported a good mean internal consistency of .88 for the RISC items averaged across eight investigations. In addition, the test-retest reliabilities of the RISC scale were .74 and .76 across two one-month periods and .67 and .63 across two two-month periods, indicating the stability of the measure (Cross et al., 2000).

Negative emotionality. As discussed in the Introduction of this chapter, I assessed state-based levels of the three core negative emotions of depression, anxiety, and stress using the DASS 21, which is the short form of the full 42-item measure (Lovibond & Lovibond, 1995). Example items are “I couldn’t seem to experience any positive feeling at all” for feelings of depression, “I felt I was close to panic” for feelings of anxiety, and “I tended to over-react to situations” for feelings of stress. Participants indicated their responses on a 4-point Likert-type scale ranging from *did*

not apply to me at all to applied to me very much, or most of the time. Investigations in British and Australian non-clinical adult samples showed that the DASS 21 had a similar factor structure and yielded comparable results to the full scale (Crawford, Cayley, Lovibond, Wilson, & Hartley, 2011; Henry & Crawford, 2005). The depression, anxiety, and stress dimensions shared a common variance with a mean loading of .60 on the general factor, but also retained variance that was specific to each dimension with a mean loading of .34. The three scale dimensions as well as the total scale had good internal consistency (Henry & Crawford, 2005). The Cronbach alpha reliabilities were .88 for depression, .82 for anxiety, and .90 for stress. The alpha for the total scale was .93. Like the full version of the DASS, Henry and Crawford (2005) reported that the short form had good convergent and divergent validities with other validated depression and anxiety measures, such as the Hospital Anxiety and Depression Scale (Zigmond & Snaith, 1983). I selected the short form of the DASS because I aimed to reduce participant fatigue given the large number of scales employed in the current study.

Help-seeking and problem-solving avoidance. Participants' help-seeking tendencies were assessed using measures of collaboration in decision-making, general help-seeking, social provisions, perceived social support, students' help-seeking tendencies, and seeking social support. Participants' problem-solving avoidance tendencies were assessed using a measure of escape-avoidance coping. I included these measures to further establish the construct validity of the IIPSS.

Collaboration in decision-making. The degree to which participants were willing to collaborate in decision-making situations was assessed using the Decision-Making Collaboration Scale (Anderson et al., 1998). An example item is "I enjoy participating in decision making." The scale has adequate validity and internal

reliability (Anderson et al., 1998). In an initial investigation of the measure, the Decision-Making Collaboration Scale correlated positively with measures of argumentativeness ($r = .58$; Infante & Rancer, 1982), communication competency ($r = .52$; Infante & Wigle, 1986), and willingness to communicate ($r = .43$; McCroskey & Richmond, 1987). Further confirming the construct validity of the Decision-Making Collaboration Scale, participants' responses to the scale items did not significantly differ from their friends' evaluations of participants' collaboration tendencies. The scale items had good internal consistency, with a Cronbach's alpha coefficient of .81 (Anderson et al., 1998).

General help-seeking. The General Help-Seeking Questionnaire (Wilson et al., 2005) assesses participants' willingness to seek help from eight specific people such as family members, a friend, or a counsellor when facing (a) general personal problems or (b) a suicidal crisis. Participants rated how likely it was for them to seek help from each person (e.g., "Doctor") on a 4-point Likert-type scale ranging from extremely unlikely to extremely likely. Wilson et al. (2005) reported adequate validity and reliability for the General Help-Seeking Questionnaire. The measure also has satisfactory predictive validity. For several help sources, such as intimate partner and family member, reported help-seeking intentions correlated positively and moderately with actual help-seeking behaviours three weeks later. Further, the General Help-Seeking Questionnaire had satisfactory internal consistency for personal problems ($\alpha = .70$) and suicidal problems ($\alpha = .83$). The test-retest reliability over a three-week period was .86 for personal problems and .88 for suicidal problems (Wilson et al., 2005).

Social provisions. The 24-item Social Provisions Scale (Cutrona & Russell, 1987) measures the degree to which social relationships provide social support and fulfil interpersonal needs. The six *social provisions*, as described by Weiss (1974), are

social integration, attachment, reliable alliance, opportunity for nurturance, reassurance of worth, and social integration. An example item for guidance is “There is someone I could talk to about important decisions in my life.” The Social Provisions Scale has been shown to correlate significantly and positively with other social support scales and with relational-interdependent self-construal (see Cutrona & Russell, 1987; Cross et al., 2000). In addition, social provisions have been shown to predict students’ perceived loneliness ratings (Russell, Cutrona, Rose, & Yurko, 1980) and to predict first-time mothers’ reports of postpartum depression (Cutrona, 1984). The Social Provisions Scale had good internal consistency with Cronbach’s alphas between .85 and .92 for the overall scale score and test-retest reliabilities between .84 and .92 (see Cutrona & Russell, 1987; Vogel & Wei, 2005).

Perceived social support. The Multidimensional Scale of Perceived Social Support (Zimet, Dahlem, Zimet & Farley, 1988) is a 12-item scale that measures the accessibility of social support from family, friends, and a significant other. An example item is “There is a special person who is around when I am in need.” In a sample comprised of 275 American undergraduate students, the Multidimensional Scale of Perceived Social Support has been shown to have good validity and reliability (Zimet et al., 1988). The overall scale score correlated negatively and significantly with symptoms of depression ($r = -.25$), as measured by the Hopkins Symptoms Checklist (Derogatis, Lipman, Rickels, Uhlenhuth, & Covi, 1974). In another American undergraduate student sample, Osman, Lamis, Freedenthal, Gutierrez, and McNaughton-Cassill (2014) presented further evidence for the construct validity of the Multidimensional Scale of Perceived Social Support. The scale was positively and significantly associated with the protective factors of Gutierrez et al.’s (2002) Reasons for Living Inventory for Young Adults (i.e., family relations, peer relations, & positive

evaluations) and negatively and significantly associated with the risk factors of the inventory (i.e., interpersonal disruptions, hopelessness, & depression). In the initial investigation, the Cronbach's alpha coefficient was .88 for the total scale, indicating good internal consistency (Zimet et al., 1988). Subsequent investigations confirmed the internal consistency of the measure with Cronbach's alpha coefficients ranging between .87 and .94 across various samples (see Osman et al., 2014). The test-retest reliability for the total scale was .85 among a subsample of 69 participants from the initial sample reported by Zimet et al. (1988).

Students' help-seeking tendencies. The 18-item Assessment of Achievement-Related and Help-Seeking Tendencies scale (Karabenick & Knapp, 1991) measures students' behaviours to counteract poor performance outcomes at university. Behaviour intentions are categorized as formal versus informal help-seeking, instrumental activities, lower aspirations, and alter goals (Karabenick & Knapp, 1991). For example, students are instructed to indicate how likely they would take actions such as "seek help from support services" and "study more" if they were experiencing poor academic performance. Achievement-related and help-seeking tendencies were significantly associated with students' final grades in a sample of 472 American students (Kitsantas & Chow, 2007). In particular, formal and informal help-seeking and instrumental activities were positively correlated with students' grades ($r_s = .17$ & $.45$ respectively). In contrast, lowering aspirations and altering goals were negatively correlated with students' grades ($r_s = -.14$ & $-.15$ respectively), supporting the validity of the measure.

Karabenick (2003) constructed a related measure that assesses help-seeking tendencies including help-seeking avoidance among university students. Subscales of the Help-Seeking Scales are instrumental help seeking, executive help seeking, help-seeking threat, help-seeking avoidance, and formal versus informal help seeking. An

example item for instrumental help-seeking is “If I were having trouble understanding the material in this course I would ask someone who could help me understand the general ideas,” and an example item for help-seeking threat is “I would feel like a failure if I needed help in this course.” Indicating construct validity, the Help-Seeking Scales dimensions were significantly correlated with relevant motivational, affective, and goal-oriented behaviours in a sample of 883 American university students. For example, help-seeking threat and avoidance were positively related to course-related anxiety ($r_s = .38$ & $.37$ respectively) but not significantly related to students’ self-efficacy in mastering the course material ($r_s = -.07$ & $-.11$ respectively), as measured by the Motivated Strategies for Learning Questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1993). Further supporting the validity of the measure, subscales of the Help-Seeking Scales were also differentially related to students’ university performance. For example, help-seeking threat and avoidance were negatively correlated with students’ grades ($r_s = -.21$ & $-.19$ respectively), whereas instrumental help seeking was positively related to students’ grades ($r = .12$). Internal consistencies reported for the subscale items ranged between $.62$ and $.81$ (Karabenick, 2003).

Seeking social support and problem-solving avoidance. Seeking social support and problem-solving avoidance were assessed using the 66-item revised Ways of Coping questionnaire (Folkman & Lazarus, 1985). Ways of coping describe thoughts and behaviours that individuals use in stressful situations. The subscales of the Ways of Coping questionnaire were derived empirically in both student and adult samples (Folkman & Lazarus, 1985; Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986). Subscales derived from 108 American undergraduate students were seeking social support, problem-focused coping, wishful thinking, detachment, focusing on the positive, self-blame, tension reduction, and keep to self. Subscales derived from a

community sample comprised of 150 American adults were seeking social support, planful problem-solving, accepting responsibility, distancing, positive reappraisal, self-controlling, confrontive coping, and escape-avoidance. An example item for seeking social support is “talked to someone who could do something concrete about the problem,” and an example item for escape-avoidance is “refused to believe that it had happened.” Participants responded to the items on a 4-point Likert-type scale ranging from *not used* to *used a great deal*.

Although it is a standard measure of coping in stressful situations, the Ways of Coping questionnaire has been criticised for its construct validity because the extracted coping dimensions change with varying samples and stressors (see Edwards & O’Neill, 1998; Parker & Endler, 1992). Internal consistencies of the subscale items range from .59 to .88 in a student population and from .62 to .79 in a community adult population (Folkman & Lazarus, 1985; Folkman, Lazarus, Dunkel-Schetter, et al., 1986). I decided to include this measure because I was interested in how theoretically relevant coping styles, especially seeking social support and escape-avoidance coping, relate to problem-solving style.

Self-esteem. Global self-esteem was measured using the Single-Item Self-Esteem Scale (Robins, Hendin, & Trzesniewski, 2001). Participants responded to the item “I have high self-esteem” on a 7-point Likert-type scale ranging from *not true* to *very true*. Robins et al. (2001) showed that the Single-Item Self-Esteem Scale has excellent convergent validity with the 10-item Rosenberg Self-Esteem Scale (Rosenberg, 1965). In a longitudinal study among 508 American undergraduate students, the median convergent correlation between the single-item scale and the Rosenberg scale was .93 across six assessments. In addition, Robins et al. showed that relevant measures have similar sized relations with the Single-Item Self-Esteem Scale

as they do with the Rosenberg Self-Esteem Scale. For example, the correlation between dispositional positive affect and the single-item self-esteem measure was .53 compared to .56 with the Rosenberg Self-Esteem Scale. Across three time points, the test-retest reliability of the Single-Item Self-Esteem Scale was .75, thus showing adequate stability over time (Robins et al., 2001).

Problem-solving behaviour. Participants' recent problem-solving behaviours at university were assessed using six self-generated items that described various ways in which participants may have sought instrumental help at university. Participants were asked to think of an academic problem that they had encountered in the past week and to then indicate whether they had used any of the six provided options. The problem-solving behaviours showed various degrees of interpersonal problem-solving. For example, the item "asked a tutor or lecturer" was interpersonal in nature, whereas the item "searched the University's website" indicated a more independent problem-solving approach. Responses were made on a 5-point Likert-type scale ranging from *not at all* to *very much*.

Paying attention. Due to the length of the study, I included a single-item indicator of whether participants were paying attention to the items in the survey. The item was based on Meade and Craig's (2012) recommendations identifying careless survey responses. Participants read "This item is checking that you are paying attention. To confirm, please respond to this item with *strongly agree*." Responses other than *strongly agree* were an indication that participants had not read the item text. I tried to position the item amongst similar looking items within the survey to decrease the likelihood that the item was easily detected based on distinctive stylistic features. Therefore, I decided to place the item within the Social Provisions Scale because the

wording and length of the paying attention item resembled the items of the Social Provisions Scale and the response format was the same for both measures.

Demographic and social class variables. Standard demographic items were measured, including age, gender, and nationality. Social class was assessed using a single-item indicator of social class, as described in Chapter 2.

Results

Preliminary Analyses

Missing values. With the exception of the demographic items, all responses were mandatory. A Little's (1988) Missing Completely at Random test was not statistically significant ($\chi^2 = 135.73$, $df = 140$, $p = .586$), indicating that there was no basis to assume that missing cases depended on key variables subject to analyses (see Little, 1988). Because the number of missing cases on age and gender was reasonably small and there was no indication that the missing cases were influencing any of the variables under the main research question, I decided to pairwise delete the missing cases.

Outliers. I noted cases that lay outside three standard deviations of the mean for each variable. Relating to Aim II, there was no multivariate outliers on problem-solving style and openness using Mahalanobis Distance with an alpha criterion of $p < .001$. However, there was one multivariate outlier on problem-solving style, openness, age, gender, and impression management. I conducted each analysis with and without outliers in order to examine whether outlier exclusions impacted on the pattern of results.

Normality. The key variables showed sufficient convergence with a normal distribution, with the exception of age. The skewness and kurtosis values for age were outside the acceptable range of ± 2.0 . To make the age distribution more symmetric, I

performed a log (base 10) transformation for age. The transformation achieved a normalisation for skewness but failed to correct positive kurtosis. Consequently, interpretations based on age need to be made with caution because kurtic variables affect statistical tests of variances and covariances (see DeCarlo, 1997).

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure. Following the procedures outlined in Study 1, I employed a principal axis factor analysis with promax rotation on the IIPSS items (Russell, 2002; Widaman, 1993). The Kaiser-Meyer-Olkin value of .91 indicated high sample adequacy for a factor analysis to proceed (Kaiser, 1974).

As shown in Figure 6.1, Cattell's (1966) scree plot showed that the eigenvalue slope tails off after the first factor and that the second factor remains in the elbow.

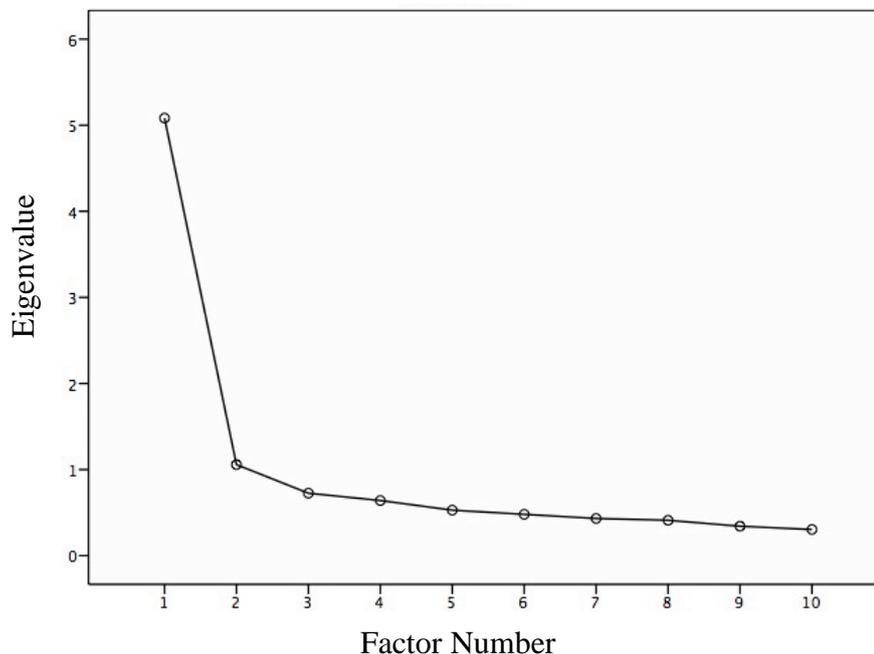


Figure 6.1. Cattell's scree plot for the IIPSS items.

I used parallel analysis (Horn, 1965) to determine whether the second factor in the elbow should be retained (see Wilson & Cooper, 2008). The parallel analysis with

100 random data sets, 10 variables, and 337 participants showed that the first factor but not the second factor exceeded the eigenvalues of the simulated data sets ($5.08 > 1.28$ & $1.06 < 1.20$, respectively). This result indicated that only one factor was present in the data. Consequently, I extracted one factor. As in Study 1, I employed the promax method of oblique rotation (see Fabrigar et al., 1999; Russell, 2002) and set the kappa value to 3 (see Tataryn et al., 1999).

Table 6.1 lists the item loadings of the single factor solution in the factor matrix. The factor accounted for 50.83% of the total variance and had an eigenvalue of 5.10. The factor loadings of all items exceeded the cut-of criteria of .30, ranging between .57

Table 6.1

Item Loadings for the 10-item IIPSS Version 2

Item	Factor
1) In general, I do not like to ask other people to help me to solve problems.	.79
2) I prefer to consult with others before making important decisions.*	.73
3) I would rather struggle through a personal problem by myself than discuss it with a friend.	.71
4) I prefer to make decisions on my own, rather than with other people.	.70
5) I usually find other people's advice to be the most helpful source of information for solving my problems.*	.69
6) I like to get advice from my friends and family when deciding how to solve my personal problems.*	.69
7) I do not like to depend on other people to help me to solve my problems.	.63
8) I value other people's help and advice when making important decisions.*	.61
9) I usually prefer to ask other people for help rather than to try to solve problems on my own.*	.61
10) When faced with a difficult personal problem, it is better to decide yourself rather than to follow the advice of others.	.57

Note. Items with asterisk are reverse scored.

and .79. As in Studies 1 and 2, the item “In general, I do not like to ask other people to help me to solve problems” obtained the largest item loading among the IIPSS items.

Descriptive statistics. Table 6.2 provides mean ratings, standard deviations, and alpha coefficients for problem-solving style, personality traits, relational-interdependent self-construal, negative emotionality, help-seeking and coping scales, self-esteem, social class, social desirability, and perceived awareness of the research hypothesis. Subscales that fell below a Cronbach’s alpha value of .70 were openness, agreeableness, conscientiousness, and tension reduction of the Ways of Coping Scale, indicating that these subscales lacked adequate internal consistency. The low convergence of the openness items feeds into the debate about what the openness construct encompasses. For example, John and Srivastava (1999) gave an overview of the historical development of the Big Five personality scales and found that the openness factor has been labelled in different ways such as openness to experience, intellect, and culture. The two BFI–10 items for openness were “I see myself as someone who has few artistic interests” and “I see myself as someone who has an active imagination.” Arguably, the first item describes cultural aspects of the openness dimension and the second item describes cognitive aspects. This difference could account for the low convergence between the two items. I proceeded by computing regression analyses with the 2-item openness subscale as well as with each item alone.

Table 6.3 shows the mean ratings and standard deviations of participants’ self-reported specific problem-solving behaviours at university in the previous week. The first four items describe interdependent problem-solving behaviours and the last two items describe independent problem-solving behaviours.

Table 6.2

Descriptive Statistics for Person-Based Variables, Self-Construal, Negative Emotionality, Help-seeking and Coping, Self-Esteem, Impression Management, and Perceived Research Awareness

	Mean	SD	Alpha
IIPSS	3.82	1.08	.89
Openness	4.67	1.15	.15
Neuroticism	4.51	1.47	.70
Agreeableness	4.76	1.14	.33
Extraversion	4.16	1.33	.64
Conscientiousness	4.84	1.00	.37
Relational-interdependent self-construal	5.16	.94	.88
DASS			
depression	10.25	9.91	.91
anxiety	8.65	8.38	.84
stress	14.64	9.93	.88
Decision-making collaboration	4.75	.86	.86
General help-seeking			
personal problem	2.44	.51	.72
suicidal crisis	2.48	.61	.78
Social provisions	5.61	.90	.94
Perceived social support	5.54	1.06	.96
Students' achievement related and help-seeking tendencies			
formal help-seeking	4.69	1.14	.73
informal help-seeking	5.10	1.13	.69
instrumental activities	6.05	.78	.78
lower aspirations	3.27	1.19	.70
alter goals	2.49	1.16	.74
Students' help-seeking			
formal versus informal help seeking	4.24	1.33	.77
instrumental help seeking	5.05	1.30	.71
executive help seeking	2.38	1.15	.72
help-seeking threat	3.25	1.57	.85
help-seeking avoidance	2.75	1.32	.85
Ways of coping			
problem-focused	2.33	.55	.79
seeking social support	2.10	.59	.74
detachment	1.94	.56	.68
self-blame	2.13	.78	.65
tension reduction	1.92	.56	.22
wishful thinking	2.33	.79	.78
keep to self	2.06	.76	.68
escape-avoidance	1.93	.58	.76
Self-esteem	3.68	1.76	N/A
Social Class	2.93	1.05	N/A
IMBIDR	81.35	16.05	.79

<i>Table 6.2 Continued</i>	Mean	SD	Alpha
PARH	3.71	1.32	.90

Note. N/A = not applicable. If not otherwise specified, scales had a theoretical range of 1 to 7. Exceptions were (a) the DASS dimensions of depression, anxiety, and stress, which had a theoretical range of 0 to 42, (b) the General Help-Seeking Scale and Ways of Coping Scale, which had a theoretical range of 1 to 4, and (c) the impression management subscale (IMBIDR), which had a theoretical range of 20 to 140.

Table 6.3

Descriptive statistics of students' specific problem-solving behaviours at university in the past week

	Mean	SD
Asked a tutor or lecturer.	2.61	1.32
Asked another student.	3.14	1.28
Asked staff in the Student Hubs.	1.67	1.09
Asked a question on Blackboard.	1.70	1.11
Checked the library.	2.41	1.38
Searched the University's website.	3.31	1.25

Note. Items had a theoretical range of 1 to 5.

Correlations. In the following, I reported the correlations in three separate tables. The first set of variables in Table 6.4 concern correlations between key variables, comparable to the correlations reported in Studies 1, 2, and 3. Tables 6.5 and 6.6 illustrate the correlations between the IIPSS and other problem-solving scales, whereby Table 6.6 also includes measures that encompass help-seeking threat, problem-solving avoidance, and self-esteem.

Table 6.4 shows the Pearson correlations between problem-solving style, personality, negative emotionality, problem-solving behaviour, social class, social desirability, and perceived awareness of the research hypotheses.

Table 6.4

Pearson Correlations Between Key Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12
1. IIPSS	—	—	—	—	—	—	—	—	—	—	—	—
2. Openness	-.01	—	—	—	—	—	—	—	—	—	—	—
3. Neuroticism	.03	-.07	—	—	—	—	—	—	—	—	—	—
4. Agreeableness	-.18**	.09	-.10	—	—	—	—	—	—	—	—	—
5. Extraversion	-.20**	.05	-.33**	.23**	—	—	—	—	—	—	—	—
6. Conscientiousness	-.02	.08	-.17**	.24**	.22**	—	—	—	—	—	—	—
7. RISC	-.37**	.05	-.01	.19**	.17**	.12*	—	—	—	—	—	—
8. Depression	.21**	.00	.44**	-.17**	-.30**	-.19**	-.21**	—	—	—	—	—
9. Anxiety	.09	-.03	.50**	-.10	-.20**	-.15**	-.04	.65**	—	—	—	—
10. Stress	.15**	-.04	.55**	-.15**	-.18**	-.06	-.07	.71*	.73**	—	—	—
11. Social Class	-.16**	-.01	-.14*	.07	.15**	.05	.06	-.14*	-.03	-.13*	—	—
12. IMBIDR	-.02	.04	-.12*	.27**	-.01	.34	.16**	-.16**	-.14*	-.23**	-.01	—
13. PARH	.04	.00	-.04	.20**	.14**	.12*	.04	-.04	.01	-.09	.12*	.05

Note. Two-tailed correlations * $p < .05$, ** $p < .01$, $N = 337$; RISC = Relational-Interdependent Self-Conceptual; IMBIDR = impression management subscale of the Balanced Inventory of Desirable Responding; PARH = Perceived Awareness of the Research Hypothesis

Confirming the convergent validity of the IIPSS, and consistent with my previous studies, problem-solving style had a weak to moderate negative correlation with agreeableness and with extraversion. These correlations suggested that interdependent problem-solvers tended to be more agreeable and extraverted than independent problem-solvers. Confirming the divergent validity of the IIPSS, there were nonsignificant correlations between problem-solving style and openness and neuroticism and conscientiousness.

Further confirming the validity of the IIPSS, problem-solving style showed a weak to moderate significant negative correlation with participants' self-reported interdependent problem-solving behaviours in the past week. In line with findings in Study 2, the IIPSS further showed no significant correlation with social desirability ($r = -.02, n = 337, p = .695$). This null correlation suggested that participants' responses to the IIPSS were not distorted by tendencies to respond in socially desirable ways (see King & Bruner, 2000).

As expected, problem-solving style was significantly negatively correlated with relational-interdependent self-construal, which indicated that an interdependent problem-solving was associated with greater relational-interdependent self-construal. Consistent with Study 1, there was a weak negative correlation between problem-solving style and participants' social class, indicating that independent problem-solvers tended to have a lower social status than interdependent problem-solvers. Problem-solving style was weakly and positively correlated with stress ($r = .15, n = 337, p = .008$) and weakly to moderately positively correlated with depression ($r = .21, n = 337, p < .01$). These results indicated that independent problem-solving was associated with higher levels of stress and depression than interdependent problem-solving.

Relating to Aim II, the null correlation between problem-solving style and openness indicated that the two predictor variables were independent from another and did not measure the same construct (see Tabachnick & Fidell, 1989). Further relating to Aim II, the dependent variables of neuroticism and anxiety showed no significant correlation with the independent variables of openness to experience and problem-solving style. The dependent variables of stress and depression showed also no significant correlation with openness but were significantly and positively correlated with problem-solving style. In line with expectations, neuroticism was strongly and positively correlated with stress, anxiety, and depression. Neuroticism, stress, anxiety, and depression scores showed no significant correlation with perceived awareness of the research hypothesis, indicating that demand characteristics were not influencing responses on the dependent measures.

In addition to problem-solving style, openness was not significantly correlated with social desirability. However, neuroticism, stress, anxiety, and depression showed weak to moderate negative associations with social desirability, indicating that participants with lower levels of negative emotionality were more prone to respond in socially desirable ways. This pattern of results concerning negative emotionality and social desirability was consistent with Study 2. Following common recommendations (see King & Bruner, 2000), I included social desirability as a covariate in subsequent regression analyses in order to examine whether social desirability distorted the predicted moderating effect of openness on the relation between problem-solving style and negative emotionality in the present study.

Table 6.5 shows the Pearson correlations between the IIPSS and other measures of problem-solving (decision-making collaboration, general help-seeking, social provisions, perceived social support, and achievement related and help seeking

tendencies). As expected, participants' tendencies to collaborate in decision-making, seeking help for personal problems and in a suicidal crisis, and to seek help from formal and informal sources at university were negatively and significantly associated with participants' problem-solving style. In addition, participants' social provisions and perceived social support in their private lives' were negatively and significantly associated with problem-solving style, meaning that interdependent problem-solvers reported higher levels of collaboration, help-seeking, and social support than independent problem-solvers. These correlations provide further evidence for the construct validity of the IIPSS.

Table 6.6 shows further correlations between problem-solving style, help-seeking, coping styles, and self-esteem. As expected, participants' tendencies to seek social support to cope with problematic situations were negatively and significantly correlated with problem-solving style. In addition, help-seeking threat and help-seeking avoidance were positively and significantly correlated with problem-solving style, indicating that independent problem-solvers felt reluctant to seek help. Establishing the divergent validity of the IIPSS, escape-avoidance coping was not significantly related to problem-solving style ($r = .08, n = 337, p = .168$), indicating that problem-solving style was unrelated to problem-solving avoidance. In line with findings regarding relational-interdependent self-construal (Cross et al., 2000; Cross et al., 2002), participants' problem-solving style was also not significantly related to self-esteem ($r = -.10, n = 337, p = .168$).

Students' problem-solving behaviours. Table 6.7 demonstrates the correlations between problem-solving style and students' self-reported specific problem-solving behaviours in the week prior to examination. Consistent with

Table 6.5
Pearson Correlations Between the IIPSS and Other Problem-Solving Scales

Variables	1	2	3	4	5	6	7	8	9	10
1. IIPSS	—	—	—	—	—	—	—	—	—	—
2. Decision-making collaboration	-.15**	—	—	—	—	—	—	—	—	—
3. GHS personal problem	-.53**	.32**	—	—	—	—	—	—	—	—
4. GHS suicidal crisis	-.44**	.30**	.75**	—	—	—	—	—	—	—
5. Social provisions	-.32**	.40**	.50**	.42**	—	—	—	—	—	—
6. Perceived social support	-.39**	.31**	.53**	.43**	.77**	—	—	—	—	—
7. AHT formal help-seeking	-.27**	.31**	.46**	.41**	.29**	.25**	—	—	—	—
8. AHT informal help-seeking	-.36**	.35**	.41**	.38**	.36**	.32**	.52**	—	—	—
9. AHT instrumental activities	-.23**	.18**	.18**	.19**	.27**	.18**	.39**	.39**	—	—
10. AHT lower aspirations	.02	-.18**	.02	-.02	-.18**	-.11*	-.03	-.07	-.12*	—
11. AHT alter goals	.07	-.10	.03	-.02	-.15**	-.07	-.08	-.17**	-.22**	.56**

Note. Two-tailed correlations * $p < .05$, ** $p < .01$, $N = 337$; GHS = General Help-Seeking Scale; AHT = Achievement-Related and Help-Seeking Tendencies

Table 6.6
Pearson Correlations Between Problem-solving Style, Students' Help-seeking, Ways of Coping, and Self-esteem

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. IIPSS	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2. HSS formal vs informal	.05	—	—	—	—	—	—	—	—	—	—	—	—	—
3. HSS instrumental	-.36**	.07	—	—	—	—	—	—	—	—	—	—	—	—
4. HSS executive	.02	-.07	-.18**	—	—	—	—	—	—	—	—	—	—	—
5. HSS help-seeking threat	.32**	-.10	-.56**	.34**	—	—	—	—	—	—	—	—	—	—
6. HSS help-seeking avoidance	.34**	-.13*	-.71**	.39**	.74**	—	—	—	—	—	—	—	—	—
7. WAYS problem-focused	-.13*	.05	.25	-.07	-.11*	-.21**	—	—	—	—	—	—	—	—
8. WAYS seeking social support	-.45**	.01	.31	.01	-.14**	-.20**	.43**	—	—	—	—	—	—	—
9. WAYS detachment	.03	.07	-.11*	.23**	.27**	-.24**	.19**	.05	—	—	—	—	—	—
10. WAYS self-blame	-.05	.07	-.04	.14**	.21**	.15**	.31**	.20**	.41**	—	—	—	—	—
11. WAYS tension reduction	.05	.05	-.08	.19**	.17**	.17**	.24**	.15**	.33**	.39**	—	—	—	—
12. WAYS wishful thinking	.04	.03	-.16**	.14**	.27**	.21**	.17**	.10	.52**	.53**	.35**	—	—	—
13. WAYS keep to self	.34**	.10	-.27**	.21**	.39**	.36**	.13*	-.18**	.48**	.41**	.32**	.54**	—	—
14. WAYS escape-avoidance	.08	-.01	-.19**	.25**	.34**	.31**	.14*	.09	.52**	.54**	.50**	.84**	.62**	—
15. Self-esteem	-.10	.00	.24**	-.01	-.29**	-.28**	.18**	.19**	-.11*	-.22**	-.05	-.24**	-.25**	-.23**

Note. Two-tailed correlations * $p < .05$, ** $p < .01$, $N = 337$; HSS = Help-Seeking Scale; WAYS = Ways of Coping Scale

Table 6.7

Pearson Correlations Between the IIPSS and Specific Problem-solving Behaviours

Variables	1	2	3	4	5	6
1. IIPSS	—	—	—	—	—	—
2. Asked a tutor or lecturer.	-.19**	—	—	—	—	—
3. Asked another student.	-.30**	.34**	—	—	—	—
4. Asked staff in the Student Hubs.	-.09	.34**	.17**	—	—	—
5. Asked a question on Blackboard.	-.06	.36**	.19**	.20**	—	—
6. Checked the library.	.01	.39**	.18**	.31**	.18**	—
7. Searched the University's website.	.01	.21**	.11	.21	.18**	.39**

Note. Two-tailed correlations * $p < .05$, ** $p < .001$, $N = 337$

expectations, asking a tutor and another student for help were negatively and significantly associated with problem-solving style, indicating that interdependent problem-solvers tend to ask their tutors and fellow students to help them solve their problems more frequently than do independent problem-solvers. Asking staff in the student hubs and posting questions on the blackboard forum were also negatively related with problem-solving style, but, contrary to expectations, these associations did not yield statistical significance ($r = -.09$, $n = 337$, $p = .087$ & $r = -.06$, $n = 337$, $p = .273$ respectively). Also contrary to expectations, checking the library and searching the university website was unrelated to independent problem-solving ($r = .01$, $n = 337$, $p = .849$ & $r = .01$, $n = 337$, $p = .825$ respectively).

Test-retest reliability. The IIPSS had satisfactory test-retest reliability with a correlation coefficient of .73 among 117 participants who completed the IIPSS in Studies 1 and 4. It should be noted, however, that the time span between Assessment 1 and 2 varied greatly among participants, ranging from one year to the same day. If only participants were included who completed the first and second assessments at least four months apart ($N = 41$), the test-retest reliability remained similar with a correlation coefficient of .79.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Post hoc power analysis. I employed a post hoc power analysis to estimate the statistical power of the current sample size to detect the interaction effect between openness and problem-solving style on neuroticism. The moderated regression model yielded an overall effect size of $f^2 = .06$ in Study 1 and an overall effect size of $f^2 = .09$ in Study 2. In Study 3, the overall effect size was $f^2 = .02$. Using G*Power Version 3.1.9 (Faul et al., 2009), I performed a post hoc power analysis for a two-tailed multiple regression statistical test with the mean of the three effect sizes of $f^2 = .06$, an alpha level of .05, a sample size of $N = 337$, and three predictor variables (i.e., openness, problem-solving style, and openness by problem-solving style interaction). Based on this analysis, the current sample had a good power value of .97 to detect the relations between openness, problem-solving style, and neuroticism.

I repeated the power analysis for the moderated multiple regression model considering age, gender, and impression management as covariates. In Study 2, the model had an overall effect size of $f^2 = .33$ when age, gender, and impression management were added as statistical controls. I re-ran the post hoc power analysis with the corresponding effect size and five predictor variables. The estimation

confirmed that the current sample had perfect power (1.00) to detect the relevant relations between the key variables with the addition of three covariates.

Moderating effect of openness. I examined the moderating effect of openness on the relation between problem-solving style and neuroticism using Model 1 of Hayes' (2013) PROCESS software. Openness and problem-solving style were mean centred prior to analysis. There was no effect of openness on neuroticism when problem-solving was at the sample mean, $b = -.06$, $SE = .07$, $t = -0.85$, $p = .394$, 95% CI [-.20, -.08], and no significant effect of problem-solving style on neuroticism when openness was at the sample mean, $b = .05$, $SE = .07$, $t = 0.68$, $p = .496$, 95% CI [-.10, .20]. Consistent with patterns of results in Studies 1, 2, and 3, there was a significant interaction between problem-solving style and openness in predicting neuroticism, $b = -.15$, $SE = .06$, $t = -2.41$, $p = .017$, 95% CI [-.27, -.03], indicating that the effect of problem-solving style on neuroticism was linearly dependent on openness.

Figure 6.2 illustrates the conditional effects of problem-solving style on neuroticism at low (-1 *SD*), medium (*M*), and high (+1 *SD*) values of openness. Consistent with patterns of findings in Studies 1, 2, and 3, at low levels of openness, independent problem-solving style had a significant positive effect on neuroticism, $b = .22$, $SE = .11$, $t = 2.11$, $p = .036$, 95% CI [.02, .43]. This result indicated that greater tendencies for independent problem-solving were associated with higher levels of reported neuroticism. At medium levels of openness, problem-solving style did not predict neuroticism, $b = .05$, $SE = .07$, $t = 0.68$, $p = .496$, 95% CI [-.10, .20]. Contrary to findings in Study 1, but in line with findings in Studies 2 and 3, problem-solving style did not predict neuroticism at high levels of openness, $b = -.12$, $SE = .10$, $t = -1.23$, $p = .220$, 95% CI [-.32, .07], respectively. The pattern of results persisted with the

exclusion of univariate and multivariate outliers and after adding impression management, age, and gender as controls.

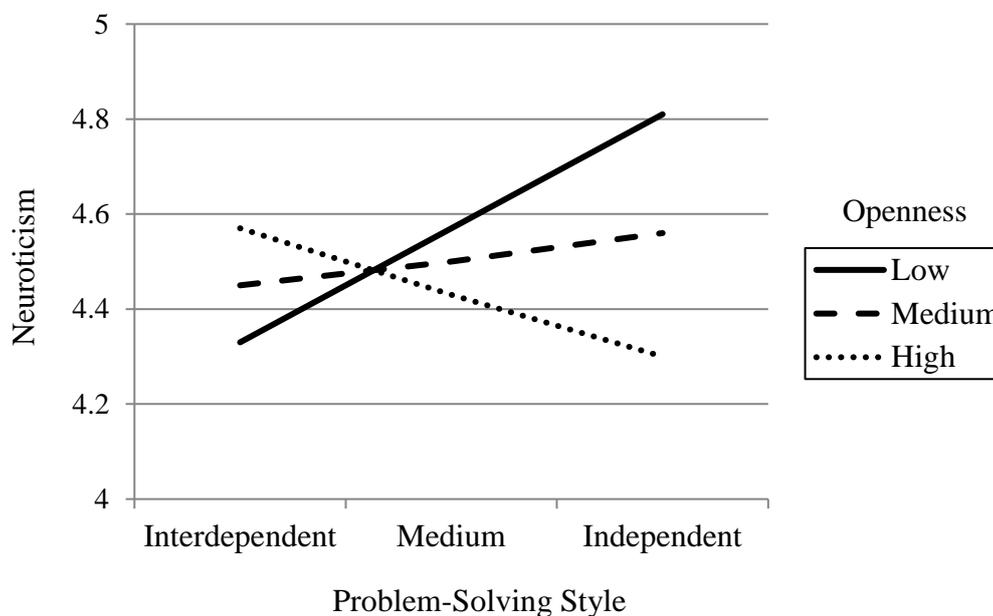


Figure 6.2. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness.

I further examined which one of the two openness items was the main contributor of the interaction effect. In line with assumptions made as part of the matching hypothesis, the interaction remained significant when the cognitive item “I see myself as someone who has an active imagination” was used as the moderator variable ($p = .027$) but not when the cultural item “I see myself as someone who has few artistic interests” was used ($p = .218$).

Alternative measures of problem-solving style. I computed additional regression analyses to examine whether related measures of problem-solving style could replicate the interaction effect. First, I examined whether seeking social support interacted with openness to predict neuroticism. There was no effect of openness on neuroticism when seeking social support was at the sample mean, $b = -.07$, $SE = .07$, $t =$

-1.00, $p = .317$, 95% CI [-.21, .07], and no significant effect of seeking social support on neuroticism when openness was at the sample mean, $b = .01$, $SE = .13$, $t = 0.10$, $p = .923$, 95% CI [-.25, .28]. However, the interaction between seeking social support and openness in predicting neuroticism was significant, $b = .32$, $SE = .12$, $t = 2.57$, $p = .011$, 95% CI [.07, .56].

Figure 6.3 illustrates the conditional effects of seeking social support on neuroticism at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. At low levels of openness, seeking social support had a significant negative effect on neuroticism, $b = -.35$, $SE = .20$, $t = -1.75$, $p = .082$, 95% CI [-.75, .04]. This result is comparable to the negative effect of interdependent problem-solving style on neuroticism at low levels of openness illustrated in Figure 6.2. At medium levels of openness, seeking social support did not predict neuroticism, $b = .01$, $SE = .13$, $t = 0.10$, $p = .922$, 95% CI [-.25, .28]. At high levels of openness, seeking social support had a marginally significant positive effect on neuroticism, $b = .38$, $SE = .19$, $t = 1.99$, $p = .047$, 95% CI [.00, .75]. This result is comparable to the negative effect of problem-solving style on neuroticism at high levels of openness, which I initially observed in Study 1. After the exclusion of outliers and after adding age, gender, and impression management as controls, the interaction effect remained significant.

Second, I examined whether relational-interdependent self-construal interacted with openness to predict neuroticism. There was no effect of openness on neuroticism when relational-interdependent self-construal was at the sample mean, $b = -.07$, $SE = .07$, $t = -1.02$, $p = .307$, 95% CI [-.21, .07], and no significant effect of relational-interdependent self-construal on neuroticism when openness was at the sample mean, $b = -.01$, $SE = .09$, $t = -0.09$, $p = .925$, 95% CI [-.18, .16]. The interaction between relational-interdependent self-construal and openness in predicting neuroticism was also

not significant, $b = .08$, $SE = .07$, $t = 1.10$, $p = .272$, 95% CI [-.06, .21], indicating that the combination of a problem-solving context and interdependent versus independent orientation described by the IIPSS drive the effect rather than the self-construal aspect alone.

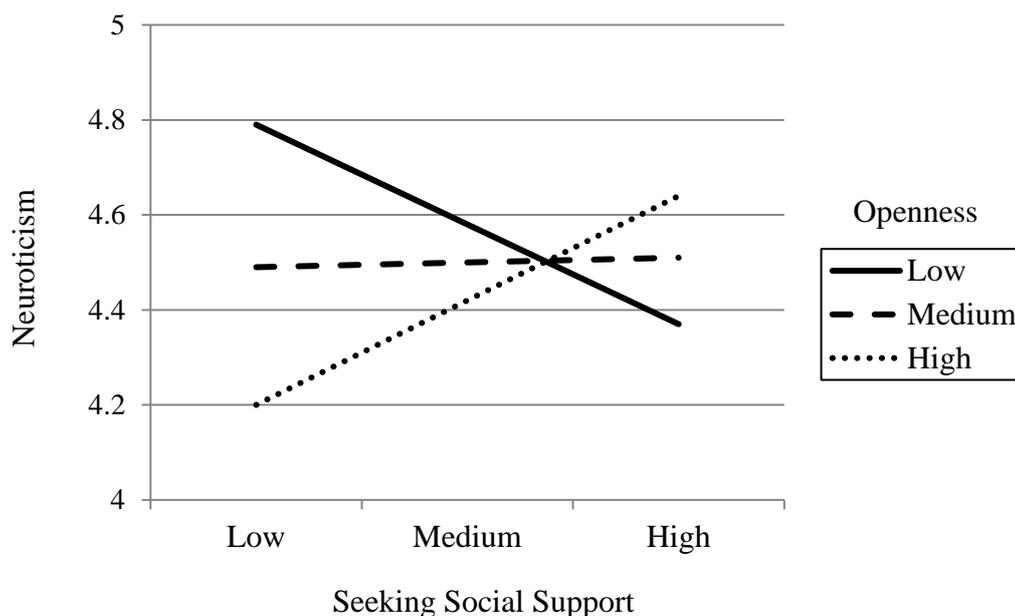


Figure 6.3. Conditional effects of seeking social support on neuroticism among participants with low (-1 *SD*), medium (*M*), and high levels (+1 *SD*) of openness.

Alternative measures of negative emotionality. I further examined whether the interactive effect of problem-solving style and openness predicts other measures of negative emotionality such as depression, anxiety, and stress. First, I examined whether problem-solving style interacted with openness to predict depression. There was no effect of openness on depression when problem-solving style was at the sample mean, $b = .21$, $SE = .46$, $t = 0.47$, $p = .640$, 95% CI [-.69, 1.12], but the effect of problem-solving style on depression when openness was at the sample mean was significant, $b = 2.03$, $SE = .49$, $t = 4.15$, $p < .001$, 95% CI [1.06, 2.99]. The interaction between

problem-solving style and openness in predicting depression was also significant, $b = -1.16$, $SE = .41$, $t = -2.81$, $p = .005$, 95% CI [-1.97, -.35].

Figure 6.4 illustrates the conditional effects of problem-solving style on depression at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. At low levels of openness, problem-solving style had a significant positive effect on depression, $b = 3.36$, $SE = .70$, $t = 4.79$, $p < .001$, 95% CI [1.98, 4.74]. This result is comparable to the positive effect of problem-solving style on neuroticism at low levels of openness illustrated in Figure 6.2. At medium levels of openness, the effect of problem-solving style on depression was also significant, $b = 2.03$, $SE = .49$, $t = 4.15$, $p < .001$, 95% CI [1.06, 2.99]. At high levels of openness, problem-solving style did not significantly predict depression, $b = .69$, $SE = .66$, $t = 1.04$, $p = .298$, 95% CI [-.61, 1.99]. After the exclusion of outliers and after adding age, gender, and impression management as controls, the interaction effect only approached significance ($p = .084$).

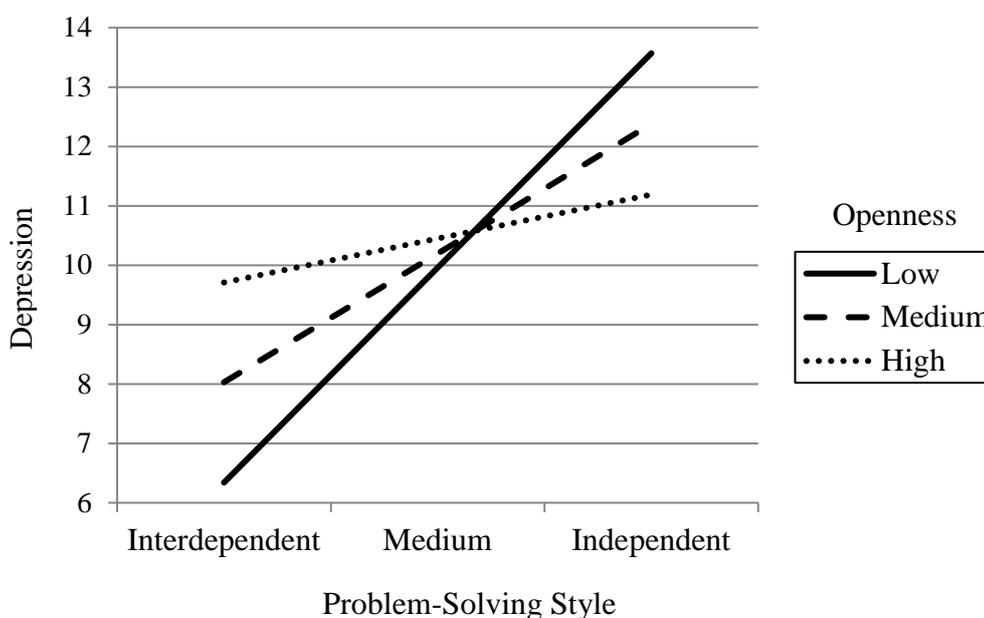


Figure 6.4. Conditional effects of problem-solving style on depression among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness.

Second, I examined whether problem-solving style interacted with openness to predict anxiety. There was no effect of openness on anxiety when problem-solving style was at the sample mean, $b = -.07$, $SE = .40$, $t = -0.17$, $p = .863$, 95% CI [-.85, .71], but the effect of problem-solving style on anxiety when openness was at the sample mean approached significance, $b = .73$, $SE = .42$, $t = 1.73$, $p = .084$, 95% CI [-.10, 1.56]. The interaction between problem-solving style and openness in predicting anxiety was significant, $b = -.81$, $SE = .36$, $t = -2.26$, $p = .025$, 95% CI [-1.51, -.10].

Figure 6.5 illustrates the conditional effects of problem-solving style on anxiety at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. At low levels of openness, problem-solving style had a significant positive effect on anxiety, $b = 1.66$, $SE = .61$, $t = 2.74$, $p = .007$, 95% CI [.47, 2.86]. This result is comparable to the positive effect of problem-solving style on neuroticism and stress at low levels of openness illustrated in Figures 6.2 and 6.4. At medium levels of openness, the effect of problem-solving style on anxiety only approached significance, $b = .73$, $SE = .42$, $t = 1.73$, $p = .084$, 95% CI [-.10, 1.56]. At high levels of openness, problem-solving style did not significantly predict anxiety, $b = -.20$, $SE = .57$, $t = -0.34$, $p = .731$, 95% CI [-1.32, .93]. After the exclusion of outliers and after adding age, gender, and impression management as controls, the interaction effect was nonsignificant ($p = .176$).

Third, I examined whether problem-solving style interacted with openness to predict stress. There was no effect of openness on stress when problem-solving style was at the sample mean, $b = -.13$, $SE = .47$, $t = -0.30$, $p = .767$, 95% CI [-.06, .78], but there was a significant effect of problem-solving style on stress when openness was at the sample mean, $b = 1.41$, $SE = .50$, $t = 2.84$, $p = .005$, 95% CI [.43, 2.38]. The interaction between problem-solving style and openness in predicting stress was also significant, $b = -1.07$, $SE = .42$, $t = -2.56$, $p = .011$, 95% CI [-1.90, -.25].

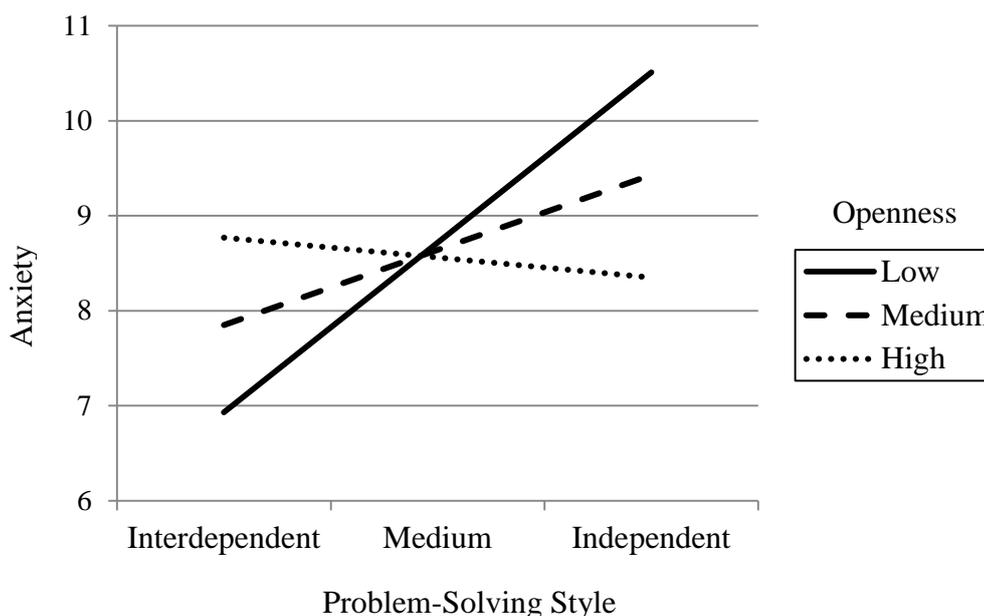


Figure 6.5. Conditional effects of problem-solving style on anxiety among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness.

Figure 6.6 illustrates the conditional effects of problem-solving style on stress at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. At low levels of openness, problem-solving style had a significant positive effect on stress, $b = 2.65$, $SE = .71$, $t = 3.71$, $p < .001$, 95% CI [1.24, 4.05]. This result is comparable to the positive effect of problem-solving style on neuroticism, stress, and anxiety at low levels of openness illustrated in Figures 6.2, 6.4, and 6.5. At medium levels of openness, problem-solving style also predicted stress significantly, $b = 1.41$, $SE = .50$, $t = 2.84$, $p = .005$, 95% CI [.43, 2.38]. At high levels of openness, problem-solving style did not significantly predict stress, $b = .17$, $SE = .67$, $t = 0.25$, $p = .803$, 95% CI [-1.15, 1.49]. After the exclusion of outliers and after adding age, gender, and impression management as controls, the interaction effect only approached significance ($p = .088$).

In summary, I found that openness moderated the relation between problem-solving style and neuroticism. Participants with an independent problem-solving style experienced more neuroticism when openness was low. At medium and high levels of

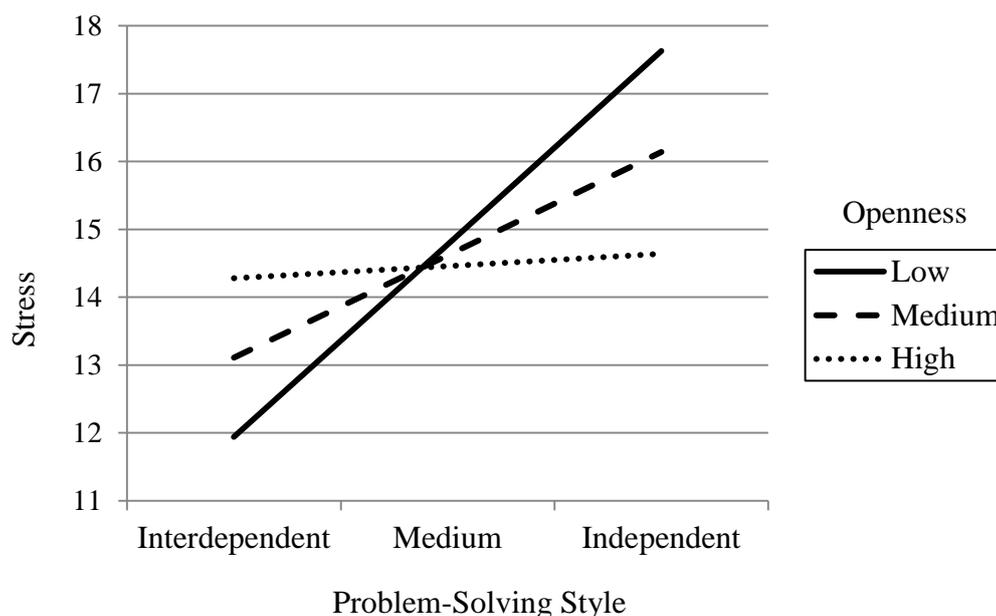


Figure 6.6. Conditional effects of problem-solving style on stress among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness.

openness, problem-solving style did not predict neuroticism. In addition, I examined whether alternative measures of independent-interdependent problem-solving style could replicate this interaction effect. Seeking social support but not relational-interdependent self-construal interacted with openness to predict neuroticism. At low levels of openness, high levels of seeking social support predicted lower levels of neuroticism. At medium levels of openness, seeking social support was unrelated to neuroticism. At high levels of openness, high levels of seeking social support predicted elevated levels of neuroticism. However, this latter effect only approached significance. I also examined whether problem-solving style and openness interact to predict the more state-based negative emotions of depression, anxiety, and stress. Independent problem-solving predicted higher levels of depression, anxiety, and stress when openness was medium and low, but especially when openness was low. The conditional effect of independent problem-solving on anxiety only approached significance when openness was at medium levels. At high levels of openness, problem-solving style did

not predict depression, anxiety, and stress. Outliers and covariations influenced the interactive effects of openness and problem-solving style on depression, anxiety, and stress but not on neuroticism.

Mediation effects of depression, anxiety, and stress. In the present study, the interactive effect of openness and problem-solving style on neuroticism was replicated. In addition, the current investigation revealed a conceptually similar effect on depression, anxiety, and stress. It is possible that state-based feelings of depression, anxiety, and depression mediate the interactive effect of openness and problem-solving style on neuroticism because neuroticism may be the chronic trait expression of those state-based negative emotions. To examine this possibility, I conducted a mediated moderation analysis using Model 8 of Hayes' (2013) PROCESS software. I entered openness and problem-solving style as predictor variables, depression, anxiety, and stress as mediator variables, and neuroticism as the outcome variable. I used 5,000 bootstrapping iterations to estimate the reliability of the indirect effect. The bias-corrected and accelerated bootstrap 95% confidence intervals showed that the indirect effect of the problem-solving style by openness interaction on neuroticism via stress and anxiety were significant, $b = -.03$, bootstrapped $SE = .02$, 95% CI $[-.08, -.00]$ for anxiety and $b = -.06$, bootstrapped $SE = .03$, 95% CI $[-.12, -.01]$ for stress. However, the indirect effect of the problem-solving by openness interaction on neuroticism via depression was not significant, $b = -.01$, bootstrapped $SE = .01$, 95% CI $[-.05, .01]$. In other words, stress and anxiety but not depression mediated the problem-solving style by openness interaction effect on neuroticism.

Hayes (2013) recommended the interpretation of this type of effect as a moderated mediation effect. Hence, I investigated the conditional mediating effect of stress and anxiety at each level of openness. At low levels of openness, stress and

anxiety were significant mediators of the relation between problem-solving style and neuroticism, $b = .14$, bootstrapped $SE = .05$, 95% CI [.06, .25] for stress and $b = .05$, bootstrapped $SE = .03$, 95% CI [.01, .14] for anxiety. At medium levels of openness, only stress was a significant mediator of the relation between problem-solving style and neuroticism, $b = .08$, bootstrapped $SE = .03$, 95% CI [.02, .15], but not anxiety, $b = .02$, bootstrapped $SE = .02$, 95% CI [-.00, .07]. At high levels of openness, neither stress nor anxiety mediated the relation between problem-solving style and neuroticism, $b = .01$, bootstrapped $SE = .04$, 95% CI [-.07, .09] for stress and $b = -.01$, bootstrapped $SE = .02$, 95% CI [-.06, .03] for anxiety. This pattern of results indicated that stress and anxiety mediated the effect of problem-solving style on neuroticism when openness was low. Stress also mediated the effect of problem-solving style on neuroticism when openness was medium. After the exclusion of outliers and controlling for age, gender, and impression management, only stress remained a significant mediator of the moderation effect ($b = -.04$, bootstrapped $SE = .02$, 95% CI [-.10, -.00] for stress and $b = -.02$, bootstrapped $SE = .02$, 95% CI [-.06, .00] for anxiety), indicating that the mediating role of stress but not anxiety was robust against the influence of outliers and covariations.

Discussion

Aim I: Testing the Psychometric Properties of the IIPSS

Similar to findings in the preceding Studies 1, 2, and 3, the IIPSS showed a single factor structure and good internal consistency in the present study. Moreover, predicted relations between social personality traits, relational-interdependent self-construals, and related help-seeking, collaboration, and coping scales confirmed the convergent validity of the IIPSS. The divergent validity of the IIPSS was indicated by non-significant correlations with measures of social desirability, demand characteristics, self-esteem, and measures of problem-solving avoidance.

Independent problem-solving style showed moderate positive correlations with help-seeking threat and help-seeking avoidance. Results also indicated that problem-solving style was significantly and negatively related to social class. Gender differences regarding problem-solving style were in the predicted direction but did not yield statistical significance.

Supporting the criterion validity of the IIPSS, students' reports of asking academic staff and fellow students to help them solve academic problems in the week prior to completing the survey were significantly and negatively related to problem-solving style. However, other behavioural indicators of problem-solving style did not yield statistical significance. Finally, confirming the test-retest validity of the IIPSS, answers to the IIPSS items remained stable across two assessments. I consider each of these findings in greater detail below.

Factor structure and internal consistency of the IIPSS. In line with results from Studies 1, 2, and 3, Version 2 of the IIPSS yielded a single factor structure in the current study, providing further evidence for the unidimensional model of the IIPSS. The IIPSS had good internal consistency with similar results compared to previous research (Rubin et al., 2012; Vieira, 2013) and results from Studies 1, 2, and 3. Across Studies 1, 2, 3, and 4, the Cronbach's alpha of the IIPSS items ranged between .85 and .89. Hence, the current study confirmed good internal consistency for Version 2 of the IIPSS.

Relation between problem-solving style and self-construal and help-seeking. The current study provided a more comprehensive account of the construct validity of the IIPSS than Studies 1, 2, and 3. In the current study, I provided further tests of the convergent validity of the IIPSS. I suggested that problem-solving style was negatively and significantly related to measures of relational-interdependent self-

construal, help-seeking, collaborative decision-making, and seeking social support coping. Consistent with results regarding Version 1 of the IIPSS (Rubin et al., 2012), problem-solving style showed a moderate and negative correlation with relational-interdependent self-construal ($r = -.37$). In addition, problem-solving style showed weak to strong negative associations with measures of help-seeking, decision-making collaboration and seeking social support coping (r s ranged between $-.15$ and $-.53$) and a moderate positive association with keeping to oneself as a way to cope with stressful situations ($r = .34$). Interestingly, problem-solving style was also significantly and positively correlated with help-seeking threat and help-seeking avoidance, indicating that independent problem-solvers perceive help-seeking as more threatening and avoid help-seeking more than interdependent problem-solvers. This latter finding also ties in with research demonstrating that part of the increased stress and burn out experienced by workaholics was due to the avoidance of delegating tasks to other people (Bonebright et al., 2000; Burke, 1999; Seybold & Salomone, 1994; Spence & Robbins, 1992). Thus, it seems that independent problem-solving does not merely encompass the notion of preferring self-reliance over a relational problem-solving approach but, at least for some individuals, it also encapsulates the active avoidance of seeking help and regarding help-seeking as a threatening act. None of the scales showed a very strong correlation with the IIPSS, indicating that the IIPSS measures a related but non-redundant construct of independent-interdependent problem-solving orientation.

Relation between problem-solving style and problem-solving avoidance. To further examine the construct validity of the IIPSS, I tested whether independent problem-solving was associated with escape-avoidance coping, a measure that describes the tendency to avoid the process of solving problems. As I explained in the Introduction, if problem-solving style correlates significantly with escape-avoidance

coping, then this association would indicate that problem-solving style is confounded with problem-solving avoidance, which is an aspect that the IIPSS is not designed to measure. Study 4's results supported the discriminant validity of the IIPSS, in that problem-solving style was not significantly correlated with escape-avoidance coping ($r = .08$). In addition, problem-solving style showed no significant correlations with other coping styles that were related to problem-solving avoidance, such as detachment, tension reduction, and wishful thinking (r s ranged from .03 to .05). Other facets that could indicate problem-solving avoidance, such as lowering aspirations and altering goals in reaction to poor performance outcomes at university, also showed no significant correlations with problem-solving style (r s = .02 & .07 respectively). However, it should be noted that problem-focused coping and instrumental activities to correct poor university performance were significantly and negatively correlated with problem-solving (r s = -.13 & -.23 respectively), indicating that interdependent problem-solvers make use of beneficial problem-solving strategies more frequently than do independent problem-solvers.

Relations between problem-solving style and social desirability and demand characteristics and self-esteem. Further establishing the discriminant validity of the IIPSS, problem-solving style was unrelated to impression management ($r = -.02$) and perceived awareness of the research hypothesis ($r = .04$), indicating that participants' desires to respond in a favourable manner and participants' perceived understanding of the research aims were not confounded with responses to the IIPSS items. These findings were in line with results from Study 2. In addition, I tested whether independent problem-solving was related to global self-esteem. In line with findings regarding relational-interdependent self-construal and global self-esteem (Cross et al.,

2000; Cross et al., 2002), problem-solving style was not significantly related to self-esteem ($r = -.10$).

Relations between problem-solving style and personality traits. In line with previous findings regarding relational-interdependent self-construal and Version 1 of the IIPSS (Cross et al., 2000; Rubin et al., 2012), Version 2 of the IIPSS correlated significantly and negatively with the social traits of extraversion and agreeableness. These associations were moderate or weak to moderate in Studies 1, 2, and 3, with the exception that the expected negative correlation between the IIPSS and extraversion was not statistically significant in Study 2. Nonetheless, supporting the convergent validity of the IIPSS, interdependent problem-solving was associated with greater levels of extraversion and agreeableness across Studies 1, 2, 3, and 4.

Cross et al. (2000) reasoned that relational-interdependent self-construal should be unrelated to the personality traits of openness and neuroticism. In line with these predictions regarding relational-interdependent self-construal, problem-solving style was not significantly related to these traits in the current study (r s ranged from $-.02$ to $.03$). In addition and in line with previous related findings in the area of support-seeking (Watson & Hubbard, 2006), problem-solving style was not significantly correlated with conscientiousness. These findings were generally consistent with results obtained in Studies 1, 2, and 3.

Criterion-related validity of the IIPSS. In addition to the predictive validity reported by Rubin et al. (2012), I examined whether problem-solving style was related to specific problem-solving behaviours that participants utilized in the week prior to completing the survey. Only two out of the six problem-solving behaviours were significantly correlated with problem-solving style. In particular, the interdependent problem-solving behaviours “asked another student” and “asked a tutor or lecturer”

were significantly and negatively related to problem-solving style ($r_s = -.30$ & $-.19$ respectively). These results indicated that, consistent with expectations, interdependent problem-solvers asked fellow students and academic staff for advice more frequently than independent problem-solvers. Other interdependent problem-solving behaviours (“asked staff in the Student Hubs” and “asked a question on Blackboard”) were also negatively correlated with problem-solving style ($r_s = -.09$ & $-.06$ respectively), but these behaviours did not yield statistical significance. Contrary to expectations, the independent problem-solving behaviours of “checked the library” and “searched the University’s website” were unrelated to problem-solving style (both $r_s = .01$).

It should be noted that the problem-solving behaviours that were investigated in this study were not objective measures. Instead, they were based on participants’ self-reports of behaviours that were enacted in the recent past. As Maroof (2012) pointed out, this procedure bears the disadvantage of requiring participants to recollect their behaviours from memory, which may lead to substantial inaccuracies as compared to objective measures of behaviour. Hence, the current investigation provided only partial support for the retrospective validity of the IIPSS. Ideally, objective measures of specific problem-solving behaviours would be assessed.

Test-retest reliability of the IIPSS. The IIPSS showed adequate test-retest reliability with a correlation coefficient of $.73$ across two time points. When analyses were restricted to participants who completed the IIPSS at least 4 months apart, the correlation coefficient remained similar ($r = .79$), demonstrating that the IIPSS had adequate stability. This outcome was in line with expectations because problem-solving style is conceptualized as a person-based tendency and, hence, should show consistency over time (see Rubin, 2011c). However, I did not expect perfect stability because individuals may adjust their problem-solving preferences according to changes in

circumstances. For example, entering university could lead to adjustments of problem-solving preferences. Students may acquire new problem-solving strategies at university as well as preferring problem-solving options that agree with their problem-solving style. Overall, the current findings suggest that the IIPSS is a reliable measure of individuals' problem-solving style and shows expected stability over time.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Replicability of the moderating effect of openness. The interaction between openness and problem-solving style on neuroticism was replicated in the current data set. When openness was low, an independent problem-solving style predicted higher levels of neuroticism. At medium and high levels of openness, problem-solving style did not predict neuroticism. This pattern of results persisted after controlling for social desirability, age, gender, and the exclusion of outliers.

The current study constituted the fourth empirical investigation in which I detected the interaction effect between problem-solving style and openness on neuroticism. The recurrence of the effect suggests that the result did not occur by chance alone. As I mentioned in previous chapters, the probability that a significant effect is due to a Type I error reduces greatly in subsequent investigations because the alpha probabilities of the results multiply. Based on the p values of Study 1 ($p < .001$), Study 2 ($p = .024$), and Study 3 ($p = .097$) the chances of obtaining a Type I error on a fourth occasion ($p = .017$) was $.001 \times .024 \times .097 \times .017 = .00000039576$, or 0.0000039576%, respectively. In other words, the chance of falsely rejecting the null hypothesis across the four studies was less than 1 in 25,000,000.

Alternative measures of problem-solving style. I examined whether seeking social support coping and relational-interdependent self-construal were suitable to

replace the IIPSS to yield the moderating effect of openness. Seeking social support coping and openness interacted to predict neuroticism ($p = .011$). Comparable to the IIPSS, seeking social support coping negatively predicted neuroticism when openness was low. The similarity in pattern of findings demonstrated that the moderating effect of openness was not dependent on a particular measurement tool but could be reproduced with a similar measure, thus supporting the validity of the interaction effect. Similar to the results for Study 1, seeking social support coping marginally and positively predicted neuroticism when openness was high. However, although the pattern of results persisted in Study 3 and the current study in regards to problem-solving style, this conditional effect at high levels of openness did not reach significance in these studies.

Importantly, the interactive effect between relational-interdependent self-construal and openness in predicting neuroticism did not yield statistical significance ($p = .272$). Hence, the interactive effect appears to be specific to problem-solving style (IIPSS) and does not generalise to the broader construct of relational-interdependent self-construal (RISC). Whereas problem-solving style and seeking social support coping capture aspects of (a) social orientation and (b) problem-solving, relational-interdependent self-construal only describes the aspect of social orientation. Hence, it seems that a combination of both aspects, namely the degree of social orientation in a problem-solving context, is required in order to reproduce the moderating effect of openness.

Alternative measures of negative emotionality. I examined whether state-based measures of negative emotionality were influenced by the moderating effect of openness. In Chapter 1, I presented examples from previous literature in which neuroticism had been operationalized as trait anxiety (e.g., Beech, 2001; Engeli et al.,

2014; Farmer et al., 2002; Goodwin & Hamilton, 2002; Zanon & Hutz, 2013) and in which neuroticism had been argued to represent chronic experiences of negative emotions such as stress and anxiety (e.g., Jorm, 1989; Munafò et al., 2005; Schinka et al., 2004; see also Lahey, 2009). Consistent with this view, in the present study, neuroticism, depression, anxiety, and stress had medium to strong associations (r s ranged from .44 – .55).

In the current study, I expected that the interactive effect of openness and problem-solving style would also predict accounts of stress, anxiety, and depression in the week prior to examination. As predicted, openness interacted with problem-solving style to predict recent feelings of stress, anxiety, and depression. These results demonstrated that the interaction effect was not restricted to chronic negative emotionality, as measured by neuroticism, but could also be found in more state-based measures of core negative emotions. In addition, a mediated moderation analysis revealed that stress and, to a lesser extent, anxiety mediated the moderating effect of openness. Conditional mediation effects showed that stress and anxiety were significant mediators of the relation between problem-solving and neuroticism when openness was low. Stress was also a significant mediator of the moderation effect when openness was at medium levels. These results indicate that the effect of problem-solving style on neuroticism is indirectly affected by stress and anxiety at low, but not at high, levels of openness.

I mentioned in the Introduction that the current study may have been subject to influences of social desirability due to the more extensive questions regarding negative emotions compared to Studies 1, 2, and 3. Because impression management correlated significantly with neuroticism, depression, anxiety, and stress, I included impression management as a covariate in addition to age and gender. While outliers and covariates

did not influence the moderating effect of openness when neuroticism was the dependent variable, the state-based emotions were influenced by extreme cases and covariations.

Limitations and Alternative Explanation

Limitations. Several limitations of the present investigation should be noted. First, in the present study, the moderating effect of openness was (a) shown to influence negative emotions of depression, anxiety, and stress and (b) mediated by stress and anxiety in predicted ways. However, these effects were weakened after controlling for outliers and covariates. Consequently, the effects of depression, anxiety, and stress remained somewhat inconclusive. I therefore determined to re-examine the moderating effect of openness on these core negative emotions in Study 5.

Second, even though the moderating effect of openness persisted in the present analysis, the internal consistency of the openness facet derived from the BFI-10 was poor. To ensure adequate scale reliability, I included the full BFI scale in Study 5.

Finally and most importantly, there is a more general limitation that applies to my previous studies as well as to the present study. The moderating effect of openness that I detected in Studies 1, 2, 3, and 4 was based on post hoc analyses. In Chapter 3, I provided a theoretical rationale for the findings based on previous high-quality research. I proposed a matching hypothesis to explain the interactive effect of problem-solving style and openness on negative emotionality. However, because I conducted my analyses on existing data sets, I have not tested the hypothesis on an a priori basis thus far. This is a limitation of my research that I addressed in a subsequent study.

Alternative explanation. An alternative explanation regarding the moderating role of openness is that the cognitive abilities associated with openness promote problem-solvers' ability to overcome potentially stressful states of indecision in the

problem-solving process. As part of the matching hypothesis, I assumed that openness is a personal resource for cognitive ability, constructive problem-solving efforts, and positive appraisals of one's own problem-solving skills. I proposed that a match between individuals' level of openness, which is related to how individuals appraise their personal problem-solving ability, and their preferred problem-solving style interacted to predict negative affect. It is possible, however, that openness and problem-solving style have joint effects because openness helps overcome indecisiveness. Previous research showed that low levels of openness were associated with various facets of career indecision (Bańka & Hauziński 2015; Lounsbury, Hutchens, & Loveland, 2005; Marcionetti, 2014). It is therefore possible that the matching hypothesis can be explained in terms of a match between individuals' personal problem-solving style and their own ability to come to a conclusion in a timely fashion. In particular, high levels of openness may alleviate stress in independent problem-solvers because openness facilitates decision-making (i.e., concluding the potentially stressful problem-solving process), and not because openness relates to positive appraisals of one's own problem-solving skills, like I proposed. In this alternative way, interdependent problem-solvers who are high in openness to experience may have a harder time to come to a conclusion by considering other people's opinions, which leads to greater negative affect compared to solving problems on an independent basis. Conversely, interdependent problem-solvers who are low in openness to experience may benefit emotionally from habitually consulting with other people because other people's suggestions help them make a decision. Thus, other people's directions help individuals low in openness to refrain from pondering on a problem alone. Consequently, the pattern of results may occur due to another mechanism than the one I previously proposed. To determine whether positive problem-solving appraisals or

indecisiveness accounts for the interactive effect of problem-solving style and openness on negative emotionality, I tested both assumptions in Study 5. In particular, I included measures of problem-solving confidence and indecisiveness to examine which of these variables interacted with problem-solving style to predict negative affect.

Implications

Some novel conclusions can be drawn from the present study that expand on the findings of the previous analyses presented in Chapters 3, 4, and 5. First, the current study provided a more in-depth investigation of the construct validity of the IIPSS. The IIPSS correlated significantly and in the expected directions with similar measures that assess relational-interdependent self-construal, help-seeking, collaboration in decision-making, interpersonal coping strategies, help-seeking threat and avoidance. In addition, the IIPSS showed divergent validities with measures that assess problem-solving avoidance, self-esteem, demand characteristics, and social desirability.

Second, an alternative measure for problem-solving style demonstrated that the moderating effect of openness is not limited to the IIPSS. Specifically, seeking social support coping interacted with openness to predict neuroticism. Analyses of the conditional effects showed that, like *interdependent* problem-solving style, social support seeking was negatively related to neuroticism at low levels of openness.

Third, the moderating effect of openness was not restricted to neuroticism but was shown to influence recent feelings of stress, anxiety, and depression. These findings supported the assumption that neuroticism constitutes a trait expression of the severity and frequency of feeling negative emotional states.

Finally, the current analyses demonstrated that state-based levels of stress, and to a lesser extent, anxiety mediated the moderating effect of openness. Albeit derived

from cross-sectional data, these results supported the notion that problem-solving style affects stress and anxiety, which in turn facilitates a more neurotic trait expression.

Chapter Seven: Study 5. An A Priori Investigation of the Moderating Effect of Openness and its Processes

Introduction

Fifth Empirical Investigation

In this fifth empirical investigation, I tested the replicability of previous findings from Studies 1 to 4 relating to Aims I and II and addressed several limitations discussed in the previous chapter. The main aim of the present study was to conduct an a priori examination of the moderating effect of openness and to investigate whether the moderating effect of openness could be explained in terms of the relation between openness and problem-solving appraisals or decisiveness. I also examined whether problem-solving style is related to people's need and ability to achieve cognitive closure.

Aim I: Testing the Psychometric Properties of the IIPSS

In the current study, I continued to investigate the factor structure of the IIPSS. I also continued to examine the relation between problem-solving style and personality traits. In addition, I aimed to further test gender and social class differences in independence and interdependence. Please refer to previous empirical chapters for more detailed descriptions regarding these investigations.

Need and ability for cognitive closure and problem-solving style. In the present study, I examined whether problem-solving style was related to the need to achieve cognitive closure. An individual's need for closure describes the need for obtaining definite answers to problems. Need for closure is characterised by the facets of preference for order, closed-mindedness, discomfort with ambiguity, preference for predictability, and desire for decisiveness (Webster & Kruglanski, 1994). Individuals

with a high need for closure show the tendency to decide on a final solution quickly, at the expense of considering alternative possibilities (see Kruglanski & Webster, 1996). Previous research has shown that the need for closure is associated with shallow cognitive engagement during learning processes, decreased consideration of alternative hypotheses, and the resistance to alter pre-established opinions (DeBacker & Crowson, 2006; Kruglanski, 2004; Kruglanski, Webster, & Klem, 1993). In addition, Roets and van Hiel (2008) demonstrated that individuals who were high in need for closure experienced higher blood pressure, elevated heart rate, and feelings of distress as long as the decision-making process was not concluded. In contrast, individuals who were low in need for closure experienced no such physical and emotional reactions during the decision-making process. These findings suggested that individuals with a high need for closure feel physically and emotionally pressed to come to a conclusion. Therefore, individuals with a high need for closure take measures that help them to conclude the decision-making process as quickly as possible in order to overcome their emotional and physical unrest. Based on the findings concerning the need for cognitive closure, I expected that need for closure and problem-solving style would be generally unrelated because individuals with a high need for closure solve problems in a way that enables them to come to conclusions quickly, regardless of whether this is in an independent manner or with the help of others. For example, independent problem-solvers could use heuristics to speed up the decision-making process (see Bar-Tal, 2010), and interdependent problem-solvers could seek encouragement for a desired solution from a close other.

In contrast to the proposed null correlation between problem-solving style and the *need* for cognitive closure, I expected that problem-solving style would show positive correlations with the *ability* to achieve cognitive structure. An individual's

ability to achieve cognitive structure is defined as the ability to organise knowledge in such a way that it is coherent with already existing cognitive frameworks (Bar-Tal, 1989). In relation to problem-solving style, I predicted that the ability to achieve cognitive structure would be positively associated with problem-solving style (i.e., independent problem-solving) because individuals who can organise information efficiently reach conclusions effectively on their own and, thus, feel no need to seek for help.

In summary, I predicted that the need for cognitive closure would be generally uncorrelated with preferences for independent or interdependent problem-solving because both independence and interdependence can be used to conclude the decision-making process in a timely fashion. However, I expected that the ability to achieve cognitive structure would be positively related to independent problem-solving style. That is individuals who have the ability to identify and structure relevant information on their own would tend to solve problems self-sufficiently.

Indecisiveness and problem-solving style. Indecisiveness has been associated with increased tendencies to seek help (Ashby, Wall, & Osipow, 1966; Ferrari, 1994; Rochlen & O'Brien, 2002; Vertsberger & Gati, 2015). Qualitative interviews revealed that undergraduate men regarded seeking counselling to overcome career indecision as a sign of indecisiveness (Rochlen & O'Brien, 2002). Vertsberger and Gati (2015) made similar but more expansive assumptions regarding the relation between indecisiveness and help-seeking. Specifically, the authors proposed that greater difficulties in making career decisions would lead to more help-seeking behaviours, but only among those students who would generally consult with others (i.e., have an interdependent problem-solving style). In line with Vertsberger and Gati's predictions, students' inclination to seek help was significantly predicted by (a) their slow speed to arrive at conclusions, (b)

their invested effort in the problem-solving process, (c) their high levels of procrastination, and (d) their frequent consultation with others (Vertsberger & Gati, 2015). Supporting these findings, American undergraduate students who had greater trait-levels of interpersonal dependencies, such as requiring constant supervision, also reported more delays in everyday decision-making situations (Ferrari, 1992; see also Ashby et al., 1966 for similar findings). Comparable to the interdependent help-seeking tendencies discussed by Vertsberger and Gati, the interdependent problem-solving style items of the IIPSS describe general tendencies to consult with others in the problem-solving process. Therefore, I assumed that interdependent problem-solvers expressed higher levels of indecision relative to independent problem-solvers. Hence, I examined whether the IIPSS showed a negative association with indecisiveness.

Self-efficacy and self-esteem and problem-solving style. I examined in the current study the divergent validities of problem-solving style in relation to appraisals of self-efficacy and self-worth. As part of the matching hypothesis, I assumed that problem-solving style would be unrelated to general feelings of self-efficacy. I aimed to assess the strength of the relations between problem-solving style and measures of self-efficacy in order to confirm the proposed independence of these variables. I also examined the divergent validity of problem-solving style in relation to two facets of self-esteem. In Study 4, problem-solving style was not significantly correlated with global self-esteem. However, measures of global self-esteem commonly assess two aspects of self-worth, namely self-liking and self-competence (Tafarodi & Milne, 2002; Tafarodi & Swann, 1995). Tafarodi and Swann (2001) described self-liking as “the valuative experience as oneself as a social object, a good or bad person” (p. 655). In contrast, self-competence is “the valuative experience of oneself as a causal agent, an intentional being that can bring about desired outcomes through exercising its will”

(Tafarodi & Swann, 2001, p. 654). In other words, self-competence is related to feelings of self-efficacy (see Tafarodi & Swann, 2001). In the previous study, I only assessed a single-item measure of global self-esteem (Single-Item Self-Esteem Scale; Robins et al., 2001), which asked participants to respond to the item “I have high self-esteem.” It is therefore possible that participants conceptualised self-esteem either more in terms of self-liking or more in terms of self-competence. To clarify the divergent validity of the IIPSS, I aimed to include a measure that distinguishes between the two aspects of self-esteem.

What types of problems do participants think about? One of the unique features of the IIPSS is that it is not context-specific. This allows for comparisons across different contexts and samples. However, because the IIPSS does not instruct participants to think of specific problems, it remains unclear which scenarios participants typically think of when responding to the scale items. To identify common problems of this particular student population, I aimed to include an open-ended question in which I asked participants about a real-life problematic situation. In order to receive a broader array of responses, I asked participants about a problem that they or a person they know encountered. I also asked participants to think of a problem that was either resolved successfully or a problem that was resolved unsuccessfully.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

In Chapter 3, I proposed a matching hypothesis to explain the interactive effect of problem-solving style and openness on negative emotionality. In particular, I assumed that when individuals high in openness preferred to solve problems independently, then this would constitute a match between individuals’ high appraisals of their problem-solving abilities and their preferred problem-solving style. However, I

assumed that when individuals high in openness preferred to solve problems with other people, then this would constitute a mismatch between individuals' personal problem-solving appraisals and their preferred problem-solving style. Conversely, I assumed that individuals who were low in openness to experience would be insecure about their own problem-solving abilities. Hence, I assumed that when individuals low in openness preferred to solve problems with other people, then this would constitute a match between individuals' poor problem-solving appraisals and their preferred problem-solving style. However, I assumed that when individuals low in openness preferred to solve problems on their own, then this would constitute a mismatch between individuals' poor problem-solving appraisals and their preferred problem-solving style. I proposed that mismatches between openness and problem-solving style at high and low levels of openness would lead to more negative emotional outcomes relative to matching characteristics at high and low levels of openness. In summary, I suggested that a match versus a mismatch between individuals' levels of openness and their preferred problem-solving styles would predict whether independence or interdependence resulted in more detrimental mental health outcomes. Study 5 represented the first a priori test of the moderating effect of openness. In particular, it examined whether the interactive effect of problem-solving style and openness on state- and trait-based negative affect could be replicated on an a priori basis. I previously demonstrated that the probability of obtaining a Type I error across four data sets is considerably small. However, a priori investigations have specific advantages over a posteriori analyses (see Kerr, 1998). In particular, a priori testing allows for the selection of appropriate measures that specifically fit the hypothesis at hand.

A priori test of the moderating effect of openness. The interactive effect of problem-solving style and openness on neuroticism was significant in Studies 1, 2, and

4. In Study 3, the interaction effect only approached significance ($p = .097$). Regarding the conditional effects, I predicted that the relation between problem-solving style and neuroticism would be positive at low levels of openness, and that the relation between problem-solving style and neuroticism would be negative at high levels of openness. The proposed positive effect of problem-solving style on neuroticism at low levels of openness was significant in Studies 1, 2, and 4. In Study 3, the conditional effect at low levels of openness was not significant ($p = .147$). The proposed negative effect of problem-solving style on neuroticism at high levels of openness was only significant in Study 1. In Studies 2, 3, and 4, the conditional effects at high levels of openness were not significant (ps ranged between .220 and .730). This indicated that the conditional effect at low levels of openness was more pronounced than the conditional effect at high levels of openness.

Alternative measures of negative emotionality. I demonstrated in Study 4 that openness and problem-solving style interacted to predict state-based negative core emotions of depression, anxiety and stress. In addition, stress and anxiety mediated the interactive effect of problem-solving style and openness on neuroticism, indicating that problem-solving style affected stress and anxiety, which in turn produced a more neurotic trait expression. However, the results in Study 4 regarding state-based negative emotions were susceptible to the influence of outliers and covariates. In the present study, I continued to examine the relations between problem-solving style, openness, and state-based negative emotions in order to acquire a more conclusive test of these relations. In addition, I aimed to examine whether the moderating effect of openness predicted cognitive and somatic anxiety scores as well as anxiety about solving problems. As part of the matching hypothesis, I assumed that openness would provide a cognitive resource that helped individuals to deal with a problem-solving

situation on an individual basis. Therefore, I aimed to examine in the present study whether the moderating effect of openness would be more pronounced for cognitive states of anxiety than for somatic states of anxiety, and whether the moderating effect of openness would specifically influence anxiety about solving problems.

The relation between openness and self-efficacy appraisals. Previously, I put forward a matching hypothesis in order to explain the moderating effect of openness to experience. In Chapter 2, I presented previous research showing that openness is related to cognitive abilities that are thought to aid in the problem-solving process (Chi & Glaser, 1985; DeYoung, 2014; DeYoung et al., 2014; Kaufman, 2013; Kaufman et al., 2010; Zillig et al., 2002). Openness has also been shown to relate to positive problem-solving approaches, such as planful problem-solving and positive appraisals of one's own problem-solving skills (Bouchard, 2003; Hartman & Betz, 2007; McMurrin et al., 2001; Moberg, 2001; Nauta, 2004; Penley & Tomaka, 2002; Rottinghaus et al., 2002). Hence, I assumed that individuals who were high in openness to experience would choose positive approaches to solving problems and thus would appraise their individual problem-solving abilities as higher than individuals who were low in openness to experience.

In the current study, I aimed to test the assumptions made under the matching hypothesis regarding problem-solving self-appraisals. In Study 3, I provided corroboratory evidence showing that variables of academics' personal problem-solving experience and efficacy appraisals interacted with problem-solving style to predict neuroticism. Specifically, academics' ratios of single-authored publications compared to their multi-authored publications were interpreted as markers for their independent problem-solving appraisals in relation to journal publications, and academics' subjective academic performance ratings were interpreted as markers for their overall

occupational self-efficacy appraisals. Because the current study was the first investigation in which I aimed to test the moderating effect of openness on an a priori basis, I included relevant self-efficacy variables that could examine the theoretical assumptions more directly. In particular, I predicted that variables measuring positive problem-solving self-appraisals such as general self-efficacy and appraisals of personal control when solving problems would interact with problem-solving style to predict negative emotions. I further predicted that the pattern of results would resemble patterns observed in the moderating effect of openness.

The relation between openness and innovative problem-solving. An important aspect of cognitive ability that may provide a resource in personal problem-solving situations is creativity. As mentioned in Chapter 2, openness has been associated with individuals' creativity (e.g., Goldberg, 1990; McCrae, 1996; McCrae & Sutin, 2009). In the present study, I aimed to test whether an innovative approach to solving problems plays a role in the moderating role of openness. Creative problem-solving is characterised by an individuals' adaptive and innovative style to solving problems (Kirton, 1976). Individuals who solve problems in an innovative manner present unconventional and novel solutions to problems, whereas individuals who solve problems in an adaptive manner choose more conventional problem-solving approaches. Von Wittich and Antonakis (2011) found that the Big Five personality traits largely explained participants' innovation styles in a sample of 213 Swiss undergraduate students. In particular, openness and extraversion positively predicted innovation style, whereas neuroticism, agreeableness, and conscientiousness negatively predicted innovation style. In a similar investigation contrasting innovators and adaptors, Kwang and Rodrigues (2002) found that innovators were significantly more open and extraverted and less conscientious than adaptors, but that there was no

significant difference between innovators' and adaptors' levels of neuroticism and agreeableness. These findings suggest that openness and innovation style are related and, thus, innovation style may pose another avenue through which high levels of openness reduces feelings of stress for independent problem-solvers relative to interdependent problem-solvers because independent problem-solvers who are high in openness believe that they can solve problems in an innovative manner on their own. In contrast, individuals who are low in openness may feel that they lack the ability to generate innovative ideas on their own. Thus, interdependent problem-solvers who are low in openness should benefit emotionally from the help of other people relative to independent problem-solvers who attempt to solve complex problems alone.

Testing an alternative explanation for the interaction effect. I also tested an alternative explanation for the interactive effect of openness and problem-solving style. In particular, it is possible that openness and problem-solving style have joint effects because openness alleviates the negative effects of indecisiveness. Previous research found that career indecision is linked to increased feelings of anxiety and neuroticism (e.g., Campagna & Curtis, 2007; Fuqua, Newman, & Seaworth, 1988; Fuqua & Seaworth, 1987; Meyer & Winer, 1993). In addition, high levels of openness are associated with a greater readiness to make career decisions, whereas low levels of openness are associated with greater hesitation to make career decisions (Bańka & Hauziński 2015; Lounsbury, Hutchens, & Loveland, 2005; Marcionetti, 2014). Hence, it is possible that a match between high levels of openness and independent problem-solving occurs because openness facilitates personal decision-making, which helps to bring a potentially anxiety-provoking problem-solving process to a quick end. In this way, individuals *high* in openness who prefer *independent* problem-solving would generally be able to conclude the problem-solving process in a timely fashion, and

would thus experience reduced feelings of negative emotions. Compared to highly open independent problem-solvers, individuals high in openness who prefer *interdependent* problem-solving would take longer to come to a conclusion because they also consider other people's opinions before making a decision. Conversely, individuals *low* in openness who prefer *independent* problem-solving would generally hesitate to make a decision, which would intensify their anxiety and worry experienced in the decision-making process. Compared to low open independent problem-solvers, individuals low in openness who prefer *interdependent* problem-solving would be able to conclude the decision-making process sooner because other people can help undecided individuals to arrive at a conclusion. For example, Rochlen and O'Brien (2002) found that undecided individuals sought career counselling to gain clarity on their career opportunities. This help-seeking situation would be similar to individuals who are low in openness and feel that they do not have the ability to come to conclusions easily. Thus, those undecided individuals would benefit from other people's assistance.

To determine whether positive problem-solving appraisals and cognitive ability or indecisiveness accounted for the interactive effect of problem-solving style and openness on negative emotionality, I aimed to test both assumptions in this study. In particular, I aimed to substitute openness with measures of problem-solving confidence, innovative problem-solving, and indecisiveness in order to examine which of these variables interacted with problem-solving style to predict negative affect.

Overview of Study 5

In the present study, student participants completed psychometric measures that assessed their personality, problem-solving styles, negative emotionality, perceptions of efficacy, creative problem-solving, need for cognitive closure, ability to achieve cognitive structure, indecisiveness, and demographic variables. Concerning the

psychometric properties of the IIPSS, I hypothesized that the IIPSS had a single factor structure and good internal consistency. I also hypothesized that the IIPSS would show expected correlations with the traits of agreeableness and extraversion as well as null correlations with the traits of neuroticism and openness. Further, I hypothesized that the IIPSS would be negatively related to social class. I also aimed to test whether men would score significantly higher on the IIPSS than women. In addition, I aimed to examine the relation between the IIPSS and need and ability for cognitive structure and indecisiveness. In particular, I hypothesized that the IIPSS would be uncorrelated with the need for cognitive structure. However, I hypothesized that the IIPSS would show positive relations with the ability to achieve cognitive closure and negative relations with indecisiveness. I also examined the divergent validity of problem-solving style in relation to various measures of self-efficacy and self-esteem.

Concerning the moderating effect of openness, I expected that the interaction effect predicted state- and trait-based levels of negative affect. I also expected that innovative problem-solving and measures of problem-solving self-efficacy and creativity would interact with problem-solving style to predict negative emotions. In addition, I aimed to test an alternative explanation for the results, which stated that openness moderated the relation between problem-solving style and negative emotionality because openness was related to the ability to overcome indecisiveness in the decision-making process. To examine this possibility, I aimed to test whether indecisiveness interacted with problem-solving style to predict negative emotions.

Method

Participants

Participants were 231 undergraduate students who were enrolled in psychology undergraduate courses and 46 undergraduate student research volunteers at an

Australian university. Participants included 192 women and 60 men whose mean age was 23.12 ($SD = 6.67$) and who ranged from 17 to 55 years. Out of the 277 participants, 229 were Caucasian, 11 were Asian, 6 were Aboriginal, 5 were African, and 2 were Torres Strait Islander. Twelve participants indicated that they held ethnicities other than the ones mentioned, and seven participants declined to indicate their ethnicity. All participants were recruited through the School of Psychology's Sona System software. Psychology undergraduate students were awarded 2% course credit points for taking part in the study.

Twenty-six participants did not reach the end of the survey and three participants declined their informed consent. Based on Meade and Craig's (2012) recommendations for conducting online surveys, participants responded to a single-item measure of truthful responding. In response to this item, 13 participants declared that they had given untrue answers. These participants were excluded from analyses on that basis. The sample size was 235 after these participant exclusions.

Procedure

Participants completed an online study titled "Would You Decide to Participate in this Study?" In the Information Statement, participants were informed that the study was "examining personality and how it influences the choices you are making."

In the current study, we asked participants about their personal problem-solving situations in an open-ended question format. To receive a wide array of responses, we asked participants about example situations in which (a) they or (b) a person they know solved a problem (c) successfully or (d) unsuccessfully. To reduce the time each participant spent on this first part of the survey, participants were randomly allocated to answer only one of the four question types. I was careful to check whether question type assignment had any effect on subsequent results.

Participants completed a battery of 19 psychometric scales. To prevent presentation-order effects, these scales were presented in randomized order, except for items relating to demand characteristics, truthful responding, demographics and social class, which were positioned at the end of the questionnaire. The median duration that participants took to complete the study was 39 minutes.

Measures

Except where indicated, all responses were made on a 7-point Likert-type scale anchored *strongly disagree* and *strongly agree*.

Problem-solving style, personality, state-based negative emotionality, demand characteristics, and truthful responses. The measures used for problem-solving style, personality traits, state-based negative emotionality, demand characteristics, and truthful responses were the same as those used in my previous studies. Problem-solving style was measured using the IIPSS, and the Big Five personality dimensions were assessed using the BFI. State-based negative emotions of depression, anxiety, and stress were assessed using the DASS 21. Demand characteristics were measured using the PARH scale, and participants' truthful responding was measured using a single-item indicator based on Meade and Craig's (2012) recommendations. Please refer to Chapters 3 and 6 for a more detailed presentation of these measures.

Problem-solving efficacy and competence in problem-solving. To assess problem-solving self-efficacy, I included the English version of the 10-item General Self-Efficacy Scale (Schwarzer & Jerusalem, 1995). According to Schwarzer (1992), general self-efficacy describes positive self-beliefs in the capabilities to solve problems and cope with difficult situations. An example item is "I can solve most problems if I invest the necessary effort." Participants responded to the items on a 4-

point Likert-type scale ranging from *not at all true* to *exactly true*. The General Self-Efficacy Scale has been shown to have good construct validity and predicted positive correlations with reports of resilience and optimistic self-beliefs and predicted negative correlations with reports of depression, anxiety, stress, and burnout in a variety of international samples (Jerusalem & Schwarzer, 1992; Luszczynska, Gutiérrez-Doña, & Schwarzer, 2005; Sagone & De Caroli, 2013; Schwarzer & Hallum, 2008; Schwarzer et al., 1997). The General Self-Efficacy Scale has also been shown to have adequate internal consistency. For example, the Cronbach's alpha value for the English version was .79 in an American student sample (Luszczynska et al., 2005).

Another indicator of problem-solving self-efficacy is individuals' appraisal of their problem-solving abilities, which I assessed using the 32-item Personal Problem-Solving Inventory (Heppner & Peterson, 1982). The subscales of the Personal Problem-Solving Inventory are problem-solving confidence, approach-avoidance style, and personal control. An example item for problem-solving confidence is "I trust my ability to solve new and difficult problems." The Personal Problem-Solving Inventory has been shown to have positive correlations with participants' satisfaction in their problem-solving skills and negative correlations with participants' stress, depression, anxiety, and hopelessness (see Heppner et al., 2004; Largo-Wight, Peterson, & Chen, 2005). In a 20-year review of the Personal Problem-Solving Inventory, reliability estimates for the total scale score as well as for the problem-solving confidence subscale score were reported to exceed .80 in a variety of international samples (see Heppner et al., 2004). The Personal Problem-Solving Inventory also showed satisfactory test-retest reliability with a correlation coefficient of .80 over a 2-week time span and a correlation coefficient of .60 over a 2-year period (see Heppner et al., 2004).

A concept that is closely related to the trait expression of self-efficacy is self-competence, which has been conceptualized as one of two dimensions describing global self-esteem (see Tafarodi & Swann, 2001). The Self-Liking Self-Competence Scale – Revised (Tafarodi & Swann, 2001) assesses these dimensions. An example item for self-liking is “I am secure in my sense of self-worth,” and an example item for self-competence is “I am highly effective at the things I do.” The revised version of the Self-Liking Self-Competence Scale showed adequate construct validity in an American student sample (Tafarodi & Swann, 2001). Self-reported self-liking and self-competence scores correlated positively with ratings provided from participants’ parents (r s ranged between .34 and .45). Internal consistencies of the subscales were also satisfactory with Cronbach’s alpha values of .90 for self-liking and .83 for self-confidence (Tafarodi & Swann, 2001).

Another indicator of efficacy in the problem-solving process is the amount and usefulness of problem-solving ideas available from oneself. I constructed a 4-item scale to assess participants’ perceived quantity and quality of solutions available from self. An example item is “I can think of many good ideas before making a decision.” Please refer to Appendix F for the other items in this self-generated scale.

To contrast participants’ appraisals of problem-solving efficacy and competence from themselves and others, I administered four self-generated items that compared participants’ perceived problem-solving competence with their perceived problem-solving competence of other people. Example items are “I am more skilled at problem-solving than a lot of other people that I know,” and “I know people who are better than me at finding solutions to problems.” In addition, I included four self-generated items that assessed participants’ perceived risk of their own solutions being wrong and four self-generated items that assessed participants’ perceived risk of other people’s

solutions being wrong. An example item assessing the risk of making wrong decisions is “My decisions are usually right,” and an example item assessing the risk of other people making wrong decisions is “Most of the time, people that I know solve problems the right way.” Please refer to Appendix F for the full list of items.

Creative problem-solving. Because openness has been shown to relate to an innovative style to solving problems (Ng & Rodrigues, 2002; von Wittich & Antonakis, 2011), I administered a modified version of the Kirton Adaptation-Innovation Inventory (Kirton, 1976). Specifically, I selected seven items that described a creative innovation style to solving problems. Example items for innovation style are “I have a lot of creative ideas,” and “I can always think of something when stuck on a problem.” Confirming the construct validity of the measure, the Kirton Adaptation-Innovation Inventory showed predicted negative correlations with conservatism, dogmatism, and inflexibility and was uncorrelated with social desirability (Kirton, 1976). The reliability of the measure is good with Cronbach’s alpha values ranging between .81 and .90 across two assessments in an American undergraduate student sample (Murdock, Isaksen, & Lauer, 1993). In addition, the Kirton Adaptation-Innovation Inventory showed good test-retest reliability with a correlation coefficient of .88 over a 7-months period (Kirton, 1976).

Need and ability to achieve cognitive closure. I assessed participants’ need for definite answers to problems using the revised Need for Closure Scale (Roets & van Hiel, 2007). The five subscales of the 41-item scale are preference for order, closed-mindedness, discomfort with ambiguity, preference for predictability, and desire for decisiveness. The original Need for Closure Scale was modified to better reflect the desire for decisiveness as compared to the ability to make decisions (Roets & van Hiel, 2007). An example item for desire for decisiveness is “I would quickly become

impatient and irritated if I would not find a solution to a problem immediately.”

Confirming the construct validity of the measure, the Need for Closure Scale has been shown to correlate positively with intolerance for uncertainty and negatively with the openness trait (Berenbaum, Bredemeier, & Thompson, 2008). The revised scale showed an improved goodness of fit compared to the original scale in two student samples (Roets & van Hiel, 2007). In addition, the internal consistency of the total scale was slightly improved for the revised version compared to the original scale, with Cronbach’s alpha values of .86 and .87 for the revised scale compared to .82 and .85 for the original scale (Roets & van Hiel, 2007).

I assessed participants’ ability to integrate novel information into their pre-existing knowledge structure using the 24-item Ability to Achieve Cognitive Structure Scale (Bar-Tal, 1994). Example items are “Even in new situations, I don’t need many cues in order to decide what is the appropriate social behaviour,” and “Only seldom do I doubt my own beliefs.” Bar-Tal and Spitzer (1999) presented previous research showing that the Ability to Achieve Cognitive Structure Scale showed a strong positive correlation with the ability to adequately use cognitive processing, as measured by the Functional Impulsivity Scale (Dickman, 1990). In addition, the Ability to Achieve Cognitive Structure Scale showed a strong negative correlation with the inability to organise perceptual material into cognitive representations, as measured by the Repression-Sensitization Scale (Byrne, 1961). The Ability to Achieve Cognitive Structure Scale was also shown to be reliable across three student samples (see Bar-Tal, 1994). Specifically, the internal consistency of the measure was .83 and the test-retest reliability across a 5-month time frame was .86.

Indecisiveness. To examine the relation between problem-solving style and indecisiveness, I included the 15-item Indecisiveness Scale (Frost & Shows, 1993),

which assesses individuals' tendencies to postpone decisions. An example item for indecisiveness is "I try to put off making decisions." Demonstrating its construct validity, the Indecisiveness Scale was shown to correlate significantly and positively with measures of procrastination and doubtfulness (Frost & Shows, 1993). In addition, student participants who scored high on indecisiveness were delayed in making decisions compared to participants who scored low on indecisiveness in an experimental setting. The measure showed good internal consistency in student samples with reported Cronbach's alpha values of .87 and .90 (Frost & Shows, 1993).

State-trait cognitive and somatic anxiety and anxiety about solving problems. I administered a modified version of the 21-item State-Trait Inventory for Cognitive and Somatic Anxiety (Ree, French, MacLeod, & Locke, 2008) to distinguish between participants' cognitive and physical symptoms of anxiety. Deviating from the original scale instructions, I gave no specific instructions regarding momentary (i.e., state) versus general (i.e., trait) feelings of anxiety because I was interested in the distinction between somatic and cognitive anxiety independent of the recency of these feelings. An example item for cognitive anxiety is "I feel agonized over my problems," and an example item for somatic anxiety is "My heart beats fast." Responses were made on a 4-point Likert-type scale ranging from *not at all* to *very much so*. Grös, Antony, Simms, and McCabe (2007) demonstrated the convergent validity in a sample of psychiatric patients. In their study, the State-Trait Inventory for Cognitive and Somatic Anxiety showed strong correlations with similar measures of anxiety, such as the State-Trait Anxiety Inventory (Spielberger, 1983) and the anxiety dimension of the DASS 21. Demonstrating adequate internal reliability, the Cronbach's alphas of the cognitive and somatic subscale items ranged between .75 and .84 in an undergraduate

student sample and between .87 and .88 in a clinical sample for the state and trait versions of measure respectively (Grös et al., 2007; Ree et al., 2008).

I also generated 4 items assessing participants' anxiety about solving problems. An example item is "If I'm making a decision that really matters, I usually get quite tense." Please refer to Appendix F for the full list of items.

Demographic and social class variables. Standard demographic items were measured, including age, gender, and nationality. Participants' social class was assessed using a single-item indicator of social class, as described in more detail in Chapter 2.

Results

Preliminary Analyses

Missing values. With the exception of the demographic items, all responses were mandatory. A Little's (1988) Missing Completely at Random test was not statistically significant ($\chi^2 = 362.78$, $df = 354$, $p = .362$), indicating that there was no basis to assume that missing cases depended on key variables subject to analyses (see Little, 1988). Because the number of missing cases for age and gender was reasonably small and there was no indication that these missing cases were influencing any of the variables under the main research question, I decided to pairwise delete the missing cases.

Outliers. I noted cases that lay outside three standard deviations of the mean for each variable. Relating to Aim II, there was no multivariate outlier on problem-solving style and openness using Mahalanobis Distance with an alpha criterion of $p < .001$. In addition, there was no multivariate outlier on problem-solving style, openness, age, and gender. I conducted each analysis with and without univariate outliers in order to examine whether outlier exclusions impacted on the pattern of results.

Normality. The key variables showed sufficient convergence with a normal distribution, with the exception of age. The skewness and kurtosis values for age were outside the acceptable range of ± 2.0 . To make the age distribution more symmetric, I performed a log (base 10) transformation for age. The transformation achieved a normalisation for skewness but failed to correct positive kurtosis. Consequently, interpretations based on age need to be made with caution because kurtic variables affect statistical tests of variances and covariances (see DeCarlo, 1997).

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure. Following the procedures outlined in Study 1, I employed a principal axis factor analysis with promax rotation on the IIPSS items (Russell, 2002; Widaman, 1993). The Kaiser-Meyer-Olkin value of .91 indicated high sample adequacy for a factor analysis to proceed (Kaiser, 1974).

As shown in Figure 7.1, Cattell's (1966) scree plot showed that the eigenvalue slope tails off after the first factor and that the second factor remains in the elbow.

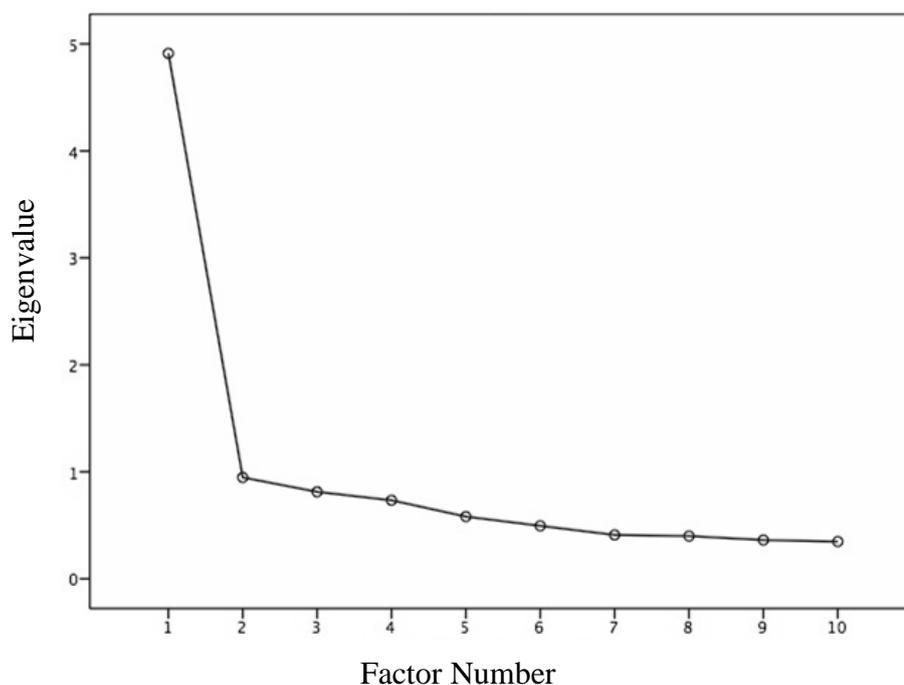


Figure 7.1. Cattell's scree plot for the IIPSS items.

I used parallel analysis (Horn, 1965) to determine whether the second factor in the elbow should be retained (see Wilson & Cooper, 2008). The parallel analysis with 100 random data sets, 10 variables, and 235 participants showed that the first factor but not the second factor exceeded the eigenvalues of the simulated data sets ($4.91 > 1.34$ & $0.95 < 1.23$, respectively). This result indicated that only one factor was present in the data. Consequently, I extracted one factor. As in Study 1, I employed the promax method of oblique rotation (see Fabrigar et al., 1999; Russell, 2002) and set the kappa value to 3 (see Tataryn et al., 1999).

Table 7.1 lists the item loadings of the single factor solution in the factor matrix. The factor accounted for 49.12% of the total variance and had an eigenvalue of 4.91. The factor loadings of all items exceeded the cut-of criteria of .30, ranging between .56 and .76. In the current study, the item “I like to get advice from my friends and family when deciding how to solve my personal problems” obtained the largest item loading among the IIPSS items.

Descriptive statistics. Table 7.2 provides mean ratings, standard deviations, and alpha coefficients for problem-solving style, personality traits, negative emotionality, need for closure and ability to achieve cognitive structure, indecisiveness, social class, perceived problem-solving skills and self-efficacy of oneself versus others, and perceived awareness of the research hypothesis. Subscales that fell below a Cronbach’s alpha value of .70 were the self-generated items of perceived risk of other and perceived awareness of the research hypothesis. Subscales that fell below a Cronbach’s alpha value of .70 were the self-generated items of perceived risk of other people's solutions being wrong and perceived competence and efficacy of self versus others, indicating that these self-generated 4-item scales lacked adequate internal

Table 7.1

Item Loadings for the 10-item IIPSS Version 2

Item	Factor
1) I like to get advice from my friends and family when deciding how to solve my personal problems.*	.76
2) In general, I do not like to ask other people to help me to solve problems.	.72
3) I prefer to consult with others before making important decisions.*	.72
4) I prefer to make decisions on my own, rather than with other people.	.70
5) I usually prefer to ask other people for help rather than to try to solve problems on my own.*	.64
6) I usually find other people's advice to be the most helpful source of information for solving my problems.*	.64
7) I would rather struggle through a personal problem by myself than discuss it with a friend.	.63
8) I do not like to depend on other people to help me to solve my problems.	.62
9) I value other people's help and advice when making important decisions.*	.59
10) When faced with a difficult personal problem, it is better to decide yourself rather than to follow the advice of others.	.56

Note. Items with asterisk are reverse scored.

consistency. Social class was a single-item measure and was thus not applicable for internal reliability measures.

Correlations. In the following, I reported the correlations in two separate tables. The first set of variables in Table 7.3 concern correlations between key variables, comparable to the correlations reported in Studies 1, 2, 3, and 4. Table 7.4 provides the correlations between openness and variables of perceived efficacy appraisals of oneself and others, the need and ability to achieve cognitive closure, and indecisiveness.

Table 7.2

Descriptive Statistics for Person-Based Variables, Negative Emotionality, Problem-Solving Confidence, Need and Ability for Cognitive Closure, Indecisiveness, Social Class, and Perceived Research Awareness

	Mean	SD	Alpha
IIPSS	3.62	1.01	.88
Openness	4.83	.76	.79
Neuroticism	4.33	1.13	.86
Agreeableness	5.14	.77	.76
Extraversion	4.22	1.10	.88
Conscientiousness	4.79	.92	.84
DASS			
Depression	9.81	9.52	.91
Anxiety	9.33	9.39	.89
Stress	13.74	9.66	.87
State-Trait Inventory for Cognitive and Somatic Anxiety			
cognitive anxiety	2.15	.76	.91
somatic anxiety	1.58	.64	.92
Anxiety about solving problems	4.33	1.20	.84
General Self-Efficacy Scale	2.99	.41	.86
Personal Problem-Solving Inventory			
problem-solving confidence	4.83	.74	.84
approach-avoidance style	4.85	.69	.81
personal control	3.78	1.02	.71
Self-Liking Self-Confidence Scale (Revised)			
self-liking	4.22	1.37	.92
self-competence	4.04	.92	.82
Perceived solution quantity and quality from self	4.53	.90	.72
Perceived competence and efficacy of self vs others	3.77	.92	.68
Perceived risk of self's solution being wrong	3.66	.97	.75
Perceived risk of others' solutions being wrong	3.78	.79	.59
Modified Kirton Adaption-Innovation Inventory			
innovation style	4.65	.86	.81
Need for Closure (Revised)	4.46	.58	.87
Ability to Achieve Cognitive Structure	3.87	.88	.90
Indecisiveness Scale	3.98	1.01	.89
Social Class	2.96	1.00	N/A
PARH	4.38	1.23	.90

Note. N/A = not applicable. Unless otherwise specified, scales had a theoretical range of 1 to 7. Exceptions were (a) the DASS dimensions of depression, anxiety, and stress, which had a theoretical range of 0 to 42 and (b) the State-Trait Inventory for Cognitive and the Somatic Anxiety and the General Self-Efficacy Scale, which had a theoretical range of 1 to 4.

Table 7.3 shows the Pearson correlations between problem-solving style, personality, negative emotionality, perceived quantity of social support, social class, and perceived awareness of the research hypotheses.

Confirming the convergent validity of the IIPSS, and consistent with my previous studies, problem-solving style had a weak to moderate negative correlation with agreeableness and with extraversion. These correlations suggested that interdependent problem-solvers were more agreeable and extraverted than independent problem-solvers. Confirming the divergent validity of the IIPSS, problem-solving style did not correlate significantly with openness and neuroticism and conscientiousness. These results were largely consistent with findings in Studies 1, 2, 3 and 4 with the exception that problem-solving style and neuroticism showed a weak positive correlation in Study 2.

In contrast to Studies 1 and 4, there was no significant correlation between problem-solving style and participants' social class ($r = -.03$, $n = 230$, $p = .627$), indicating that problem-solving style and social class were unrelated in the current study. Contrary to findings in Study 4, problem-solving style was not significantly correlated with depression ($r = .12$, $n = 235$, $p = .069$) and stress ($r = .05$, $n = 235$, $p = .440$). These results indicated that problem-solving style was not associated with the negative emotions of stress and depression in the current study. However, problem-solving style showed a weak negative correlation with anxiety about solving problems, suggesting that interdependent problem-solvers reported greater feelings of anxiety in problem-solving situations.

Relating to Aim II, the null correlation between problem-solving style and openness indicated that the two predictor variables did not measure the same construct (see Tabachnick & Fidell, 1989). Further, the negative emotions of neuroticism,

Table 7.3
Pearson Correlations Between Key Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13
1. IIPSS	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Openness	-.04	—	—	—	—	—	—	—	—	—	—	—	—
3. Neuroticism	-.04	-.07	—	—	—	—	—	—	—	—	—	—	—
4. Agreeableness	-.21**	.18**	-.26**	—	—	—	—	—	—	—	—	—	—
5. Extraversion	-.16*	.04	-.33**	.22**	—	—	—	—	—	—	—	—	—
6. Conscientiousness	.07	.07	-.27**	.25**	.13*	—	—	—	—	—	—	—	—
7. Depression	.12	.12	.56**	-.19**	-.25**	-.37**	—	—	—	—	—	—	—
8. Anxiety	.07	.07	.63**	-.22**	-.26**	-.31**	.68**	—	—	—	—	—	—
9. Stress	.05	.05	.66**	-.20**	-.16*	-.23**	.73**	.80**	—	—	—	—	—
10. Somatic Anxiety	.05	-.04	.60**	-.15**	-.24**	-.28**	.66**	.82**	.72**	—	—	—	—
11. Cognitive Anxiety	-.04	-.01	.70**	-.17**	-.26**	-.36**	.73**	.68**	.72**	.76**	—	—	—
12. Anxiety About Solving Problems	-.13*	-.15*	.68**	-.06	-.20**	-.27**	.42**	.46**	.54**	.49**	.57**	—	—
13. Social Class	-.03	.05	-.14*	-.06	.11	.06	-.06	-.05	-.08	-.09	-.07	-.03	—
14. PARH	.07	-.01	-.03	-.03	.03	.07	.05	.05	.07	.03	-.03	.02	.03

Note. Two-tailed correlations * $p < .05$, ** $p < .001$, $N = 235$; PARH = Perceived Awareness of the Research Hypothesis

depression, anxiety, stress, cognitive and somatic anxiety showed no significant correlations with the independent variables of openness to experience and problem-solving style. However, anxiety about solving problems showed small but significant negative correlations with both independent variables. In line with expectations, neuroticism was strongly and positively correlated with depression, anxiety, stress, cognitive and somatic anxiety, and anxiety about solving problems. Variables describing negative emotions showed no significant correlations with perceived awareness of the research hypothesis, indicating that demand characteristics were not influencing responses on the dependent measures.

Table 7.4 shows the Pearson correlations between problem-solving style, perceived efficacy available from oneself and others, an innovative style to solving problems, the need and ability to achieve cognitive closure, and participants' degree to which they experience indecisiveness in the decision-making process. In line with findings in Study 4 showing that problem-solving style and global self-esteem had divergent validity, problem-solving style was not significantly correlated with participants' self-esteem appraisals of self-liking ($r = -.07, n = 235, p = .300$). However, the positive relation between problem-solving style and self-esteem appraisals of self-competence approached significance ($r = .12, n = 235, p = .056$), indicating that a more fine-grained approach of the relation between problem-solving style and self-esteem yielded more nuanced results. Further, although the relation between general self-efficacy and problem-solving style was nonsignificant ($r = .10, n = 235, p = .121$), specific appraisals of one's personal self-efficacy and competence versus the perceived self-efficacy and competence of other people showed a weak to moderate significant positive correlation. In addition, problem-solving style showed a moderate positive correlation with participants' perceived risk of wrong solutions from others.

Table 7.4

Pearson Correlations Between IIPSS and Perceived Efficacy Appraisals and Innovation Style to Solving Problems and Need and Ability for Cognitive Closure and Indecisiveness

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. IIPSS	—	—	—	—	—	—	—	—	—	—	—	—	—	—
2. General Self-Efficacy Scale	.10	—	—	—	—	—	—	—	—	—	—	—	—	—
3. PPSI probl.-solving confidence	.12	.76**	—	—	—	—	—	—	—	—	—	—	—	—
4. PPSI approach-avoidance style	-.06	.39**	.41**	—	—	—	—	—	—	—	—	—	—	—
5. PPSI personal control	.10	.58	.60**	.42**	—	—	—	—	—	—	—	—	—	—
6. SLSCS self-liking	-.07	.49**	.49**	.14*	.42**	—	—	—	—	—	—	—	—	—
7. SLSCS self-competence	.12	.65**	.63**	.26**	.54**	.60**	—	—	—	—	—	—	—	—
8. Quan. & Qual. Solution Self	.09	.56**	.56**	.53**	.54**	.31**	.45**	—	—	—	—	—	—	—
9. Effic. & Compet. Self vs Others	.27**	.48**	.53**	.25**	.39**	.27**	.52**	.49**	—	—	—	—	—	—
8. Risk Wrong Solutions / Self	-.10	-.60**	-.66**	-.30**	-.52**	-.53**	-.61**	-.49**	-.51**	—	—	—	—	—
9. Risk Wrong Solutions / Others	.30**	-.08	-.15*	-.15*	-.16*	-.17**	-.13**	-.05	.21**	.22**	—	—	—	—
12. KAI innovation style	-.01	.28**	.37**	.26**	.16*	.08	.23**	.33**	.17**	-.18**	-.09	—	—	—
13. Need for Closure	.01	-.13*	-.04	.03	-.20**	-.20**	-.08	-.21**	-.01	.10	.01	-.19**	—	—
14. AACCS	.10	.58**	.60**	.21**	.63**	.63**	.66**	.49**	.43**	-.63**	-.17*	.09	-.22**	—
15. Indecisiveness Scale	-.18**	-.60**	-.64**	-.27**	-.63**	-.54**	-.64**	-.49**	-.47**	.63**	.15*	-.12	.11	-.85**

Note. Two-tailed correlations * $p < .05$, ** $p < .01$, $N = 235$; PPSI = Personal Problem-Solving Inventory; SLSCS = Self-Liking Self-

Confidence Scale (Revised); KAI = Kirton's Adaptation-Innovation Inventory; AACCS = Ability to Achieve Cognitive Structure

These latter results indicated that a preference for independent problem-solving is related to greater perceived personal problem-solving competence relative to the competence of other people, and that a preference for independent problem-solving may be motivated by the belief that solutions presented by others might be wrong.

As expected, participants' need for cognitive closure was not significantly correlated with problem-solving style. This result indicated that the desire to come to conclusions in a timely fashion was unrelated to participants' preferences for independent or interdependent problem-solving. As expected, participants' indecisiveness showed a weak but significant negative correlation with problem-solving style, indicating that undecided individuals tend to routinely ask other people for their opinions. Although there was an expected positive correlation between the ability to achieve cognitive closure and problem-solving style, the correlation did not yield statistical significance ($r = .10, n = 235, p = .118$).

Common problems experienced by participants. I also examined the kinds of problematic situations participants or people they knew experienced. Participants who reported problems from other people typically reported problems from friends, family members, and relationship partners. To extract the issues participants identified, I made note of the problem areas participants put forward. When participants mentioned two interrelated problems (e.g., depressive episode because of bullying at work), I made note of both problem areas (e.g., mental health problem and work-related problem). The main problem area participants raised concerned balancing studies, work, and social life (27%). Similar problems participants described concerned issues at work (12%) and issues with academia (11%). Interpersonal problems were also mentioned and concerned problematic situations among relationship partners (10%), friends (10%), and family members (10%). Less common problem areas (< 5%) concerned mental

health, physical health, finances, hobbies, traffic, internet, property, security, and personal growth.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Power analysis. I employed an a priori power analysis to estimate the statistical power of the current sample size to detect the interaction effect between openness and problem-solving style on neuroticism. The moderated regression model yielded an overall effect size of $f^2 = .06$ in Study 1 and an overall effect size of $f^2 = .09$ in Study 2. In Studies 3 and 4, the overall effect size was $f^2 = .02$. Using G*Power Version 3.1.9 (Faul et al., 2009), I performed an a priori power analysis for a two-tailed multiple regression statistical test with the mean of the four effect sizes of $f^2 = .05$, an alpha level of .05, and a power of .80, and three predictor variables (i.e., openness, problem-solving style, and openness by problem-solving style interaction). Based on this analysis, the current investigation required a sample size of $N = 309$ to detect the relations between openness, problem-solving style, and neuroticism. Hence, I aimed to collect a sample size of around $N = 309$ participants in order to reliably investigate the relations of interest. Unfortunately, due to time constraints, I had to conclude the study prematurely at a sample size of $N = 277$. The sample decreased further to $N = 235$ after participant exclusions, which I described in greater detail in the Participants subsection above. This reduced the power of my tests from .80 to .69, which is still reasonably acceptable (see Rubin & Babbie, 2010).

Moderating effect of openness. I examined the moderating effect of openness on the relation between independent-interdependent problem-solving style and neuroticism using Model 1 of Hayes' (2013) PROCESS software. Openness and problem-solving style were mean centred prior to analysis. There was no effect of

openness on neuroticism when problem-solving was at the sample mean, $b = -.15$, $SE = .10$, $t = -1.57$, $p = .118$, 95% CI [-.35, .04], and no significant effect of problem-solving style on neuroticism when openness was at the sample mean, $b = -.04$, $SE = .07$, $t = -.51$, $p = .611$, 95% CI [-.18, .11]. Consistent with Studies 1, 2, 3, and 4, there was a significant interaction between problem-solving style and openness in predicting neuroticism, $b = -.24$, $SE = .09$, $t = -2.75$, $p = .006$, 95% CI [-.41, -.07], indicating that the effect of problem-solving style on neuroticism was linearly dependent on openness.

Figure 7.2 illustrates the conditional effects of problem-solving style on neuroticism at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. Although the pattern of findings was as predicted at low levels of openness, the positive relation between problem-solving style and neuroticism did not reach statistical significance, $b = .14$, $SE = .10$, $t = 1.45$, $p = .149$, 95% CI [-.05, .34]. At medium levels of openness, problem-solving style did also not predict neuroticism, $b = -.04$, $SE = .07$, $t = -.51$, $p = .611$, 95% CI [-.18, .11]. Similar to Study 1, at high levels of openness, problem-solving style was negatively correlated with neuroticism, $b = -.22$, $SE = .10$, $t = -2.26$, $p = .025$, 95% CI [-.41, -.03]. There were no univariate or multivariate outliers. The pattern of results persisted after adding age and gender as controls.

Alternative measures of negative emotionality. I further examined whether the interactive effect of problem-solving style and openness predicted other measures of negative emotionality such as depression, anxiety, stress, cognitive and somatic anxiety, and anxiety about solving problems. This was to test whether the joint effect of openness and problem-solving style predicted other indicators of negative emotionality apart from neuroticism. Because neuroticism is a trait measure of negative emotionality, it was important to test whether the interaction effect would also influence more state-based measures of negative emotionality. None of the variables were

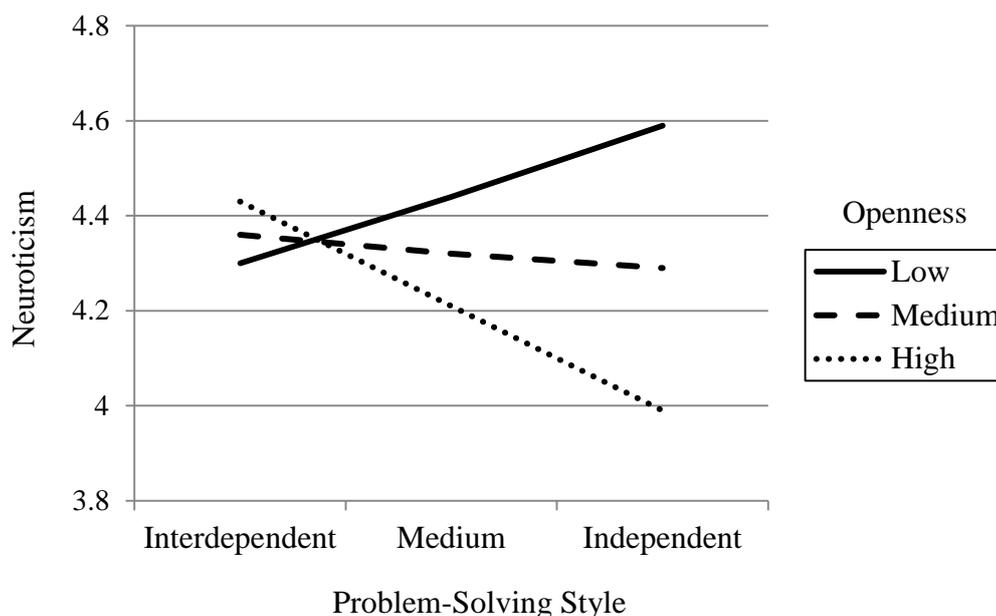


Figure 7.2. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness.

significantly influenced by the joint effect of openness and problem-solving style with the exception of anxiety. There was no effect of openness on anxiety when problem-solving style was at the sample mean, $b = -.76$, $SE = .82$, $t = -.92$, $p = .357$, 95% CI [-2.38, .86], and there was no effect of problem-solving style on anxiety when openness was at the sample mean, $b = .70$, $SE = .60$, $t = 1.15$, $p = .251$, 95% CI [-.49, 1.89]. However, the interaction between problem-solving style and openness in predicting anxiety was significant, $b = -1.46$, $SE = .73$, $t = -2.02$, $p = .045$, 95% CI [-2.89, -.04].

Figure 7.3 illustrates the conditional effects of problem-solving style on anxiety at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. Consistent with findings in Study 4, at low levels of openness, problem-solving style had a significant positive effect on anxiety, $b = 1.80$, $SE = .83$, $t = 2.18$, $p = .030$, 95% CI [0.17, 3.43]. At medium and high levels of openness, the effect of problem-solving style on anxiety was not significant ($b = .70$, $SE = .60$, $t = 1.15$, $p = .251$, 95% CI [-0.49, 1.89] & $b = -$

.41, $SE = .80$, $t = -.51$, $p = .609$, 95% CI [-2.00, 1.17], respectively). Similar to Study 4, after the exclusion of outliers and after adding age and gender as controls, the interaction effect was not significant ($p = .140$).

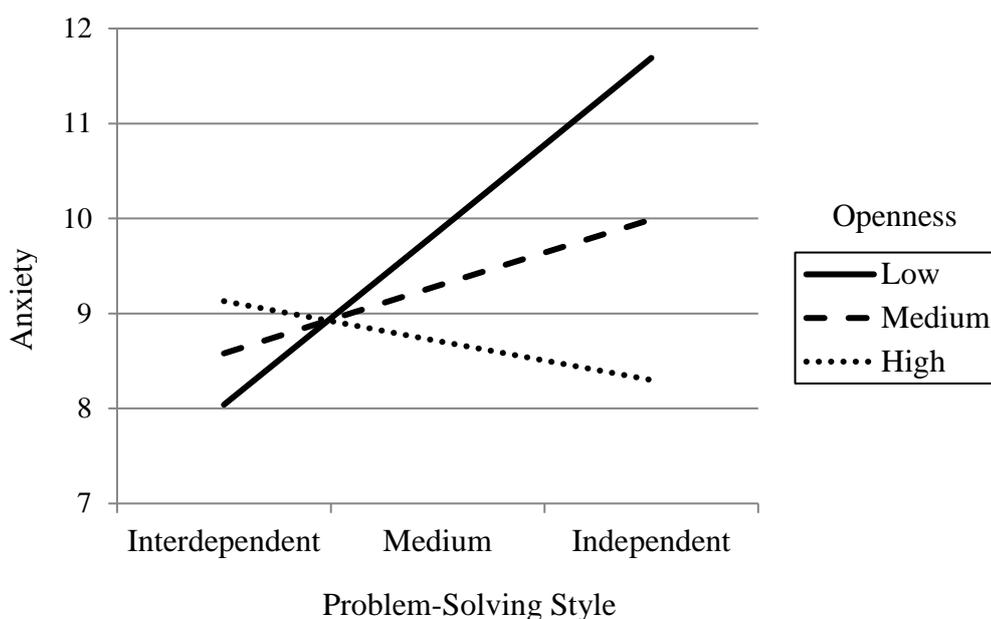


Figure 7.3. Conditional effects of problem-solving style on anxiety among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness.

The moderating effects of self-efficacy, creativity, and indecisiveness in predicting negative emotions. I further examined whether measures of positive personal appraisals such as self-efficacy and creativity interacted with problem-solving style to predict negative emotions. This was to test whether openness' relatedness to the constructs of self-efficacy and creativity accounted for the joint effect of openness and problem-solving style on negative emotionality. Significant interaction effects with these related measures of openness would support the matching hypothesis that I proposed in Chapter Three to explain the moderating effect of openness. In addition, I examined whether indecisiveness interacted with problem-solving style to predict negative emotions. This was to test whether an alternative explanation could explain

the moderating effect of openness. Unless otherwise stated, there were no univariate or multivariate outliers for the reported analyses, and the pattern of results persisted after adding age and gender as controls.

Self-efficacy variables. First, I examined whether problem-solving style interacted with general self-efficacy to predict negative emotions. I found that there was an interactive effect of problem-solving style and general self-efficacy on anxiety about solving problems. Regression analysis showed that there was a significant effect of general self-efficacy on anxiety about solving problems when problem-solving style was at the sample mean, $b = -1.62$, $SE = .16$, $t = -10.42$, $p < .001$, 95% CI [-1.92, -1.31], but the effect of problem-solving style on anxiety about solving problems when general self-efficacy was at the sample mean was not significant, $b = -.09$, $SE = .06$, $t = -1.46$, $p = .145$, 95% CI [-.21, -.13]. The interaction between problem-solving style and general self-efficacy in predicting anxiety about solving problems was significant, $b = -.41$, $SE = .14$, $t = -2.90$, $p = .004$, 95% CI [-.68, -.13].

Figure 7.4 illustrates the conditional effects of problem-solving style on anxiety about solving problems at low ($-1 SD$), medium (M), and high ($+1 SD$) values of general self-efficacy. At low and medium levels of general self-efficacy, problem-solving style had no significant effect on anxiety about solving problems ($b = .75$, $SE = .08$, $t = .90$, $p = .370$, 95% CI [-.09, .24] & $b = -.09$, $SE = .06$, $t = -1.46$, $p = .145$, 95% CI [-.21, .03], respectively). At high levels of general self-efficacy, problem-solving style negatively predicted anxiety about solving problems, $b = -.26$, $SE = .08$, $t = -3.03$, $p = .003$, 95% CI [-.42, -.09]. This result is comparable to the negative effect of problem-solving style on neuroticism at high levels of openness illustrated in Figure 7.2.

Second, I examined whether problem-solving style interacted with personal control to predict negative emotions. I found that the joint effect of problem-solving

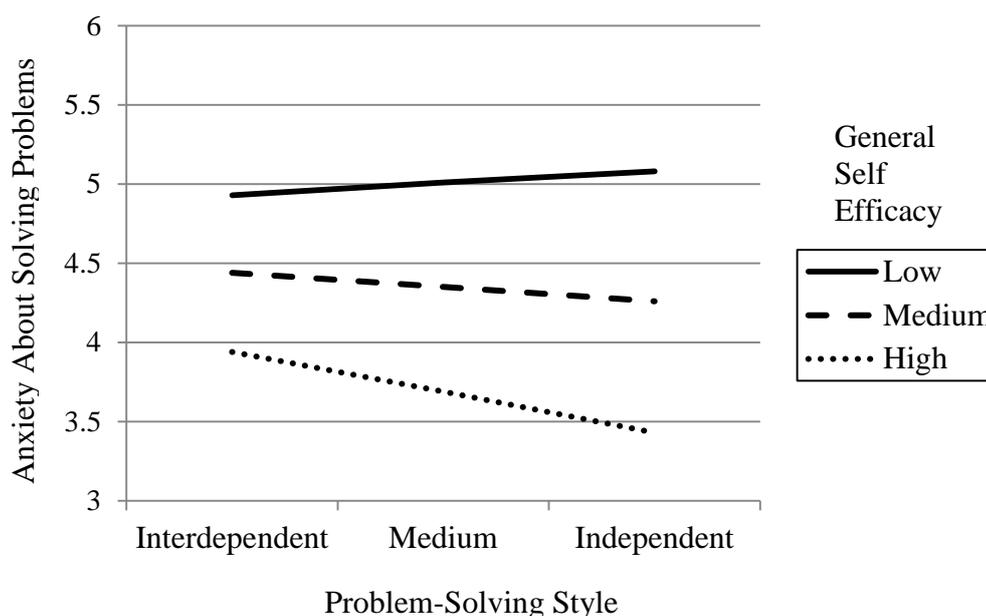


Figure 7.4. Conditional effects of problem-solving style on anxiety about solving problems among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of general self-efficacy.

style and personal control on anxiety approached significance. There was a significant effect of personal control on anxiety when problem-solving style was at the sample mean, $b = -3.47$, $SE = .57$, $t = -6.14$, $p < .001$, 95% CI $[-4.59, -2.36]$, but the effect of problem-solving style on anxiety when personal control was at the sample mean only approached significance, $b = .98$, $SE = .56$, $t = 1.76$, $p = .079$, 95% CI $[-.12, 2.08]$. The interaction between problem-solving style and personal control in predicting anxiety also only approached significance, $b = -1.03$, $SE = .55$, $t = -1.88$, $p = .062$, 95% CI $[-2.12, .05]$.

Figure 7.5 illustrates the conditional effects of problem-solving style on anxiety at low ($-1 SD$), medium (M), and high ($+1 SD$) values of personal control. At low levels of personal control, problem-solving style positively predicted anxiety, $b = 2.04$, $SE = .76$, $t = 2.67$, $p = .008$, 95% CI $[.53, 3.54]$. This result indicated that independent problem-solving positively predicted anxiety when personal control appraisals were

low. This result is similar to patterns of findings in Studies 1, 2, 3, and 4, which showed that independent problem-solving predicts negative emotions when openness is low. At medium levels of personal control, the positive relation between problem-solving style and anxiety only approached significance, $b = .98$, $SE = .56$, $t = 1.76$, $p = .079$, 95% CI [-.12, 2.08]. At high levels of personal control, the relation between problem-solving style and anxiety was nonsignificant, $b = -.07$, $SE = .82$, $t = -.09$, $p = .932$, 95% CI [-1.69, 1.55]. After the exclusion of outliers and after adding age and gender as controls, the interaction effect still only approached significance ($p = .078$).

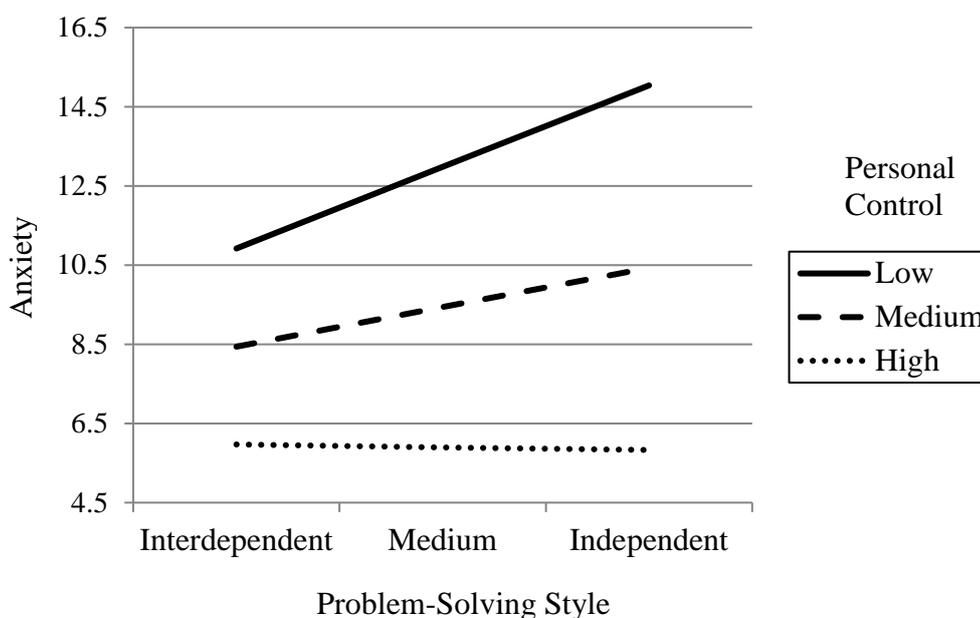


Figure 7.5. Conditional effects of problem-solving style on anxiety among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of personal control.

Creativity. I examined whether an innovative approach to solving problems interacted with problem-solving style to predict negative emotionality. I found that the joint effect of problem-solving style and innovation style on neuroticism was significant. Regression analysis showed that there was a significant effect of innovation style on neuroticism when problem-solving style was at the sample mean, $b = -.17$, $SE =$

.08, $t = -2.01$, $p = .045$, 95% CI [-.34, -.00], but the effect of problem-solving style on neuroticism when innovation style was not significant, $b = -.06$, $SE = .07$, $t = -.85$, $p = .394$, 95% CI [-.20, .08]. The interaction between problem-solving style and innovation style in predicting neuroticism was significant, $b = -.18$, $SE = .08$, $t = -2.21$, $p = .028$, 95% CI [-.34, -.02].

Figure 7.6 illustrates the conditional effects of problem-solving style on neuroticism at low ($-1 SD$), medium (M), and high ($+1 SD$) values of innovation style. At low and medium levels of innovation style, problem-solving style had no significant effect on neuroticism ($b = .09$, $SE = .10$, $t = .94$, $p = .351$, 95% CI [-.10, .28] & $b = -.06$, $SE = .07$, $t = -.85$, $p = .394$, 95% CI [-.20, .08], respectively). At high levels of innovation style, problem-solving style negatively predicted neuroticism, $b = -.21$, $SE = .10$, $t = -2.08$, $p = .039$, 95% CI [-.42, -.01]. This result is comparable to the negative effect of problem-solving style on neuroticism at high levels of openness illustrated in Figure 7.2.

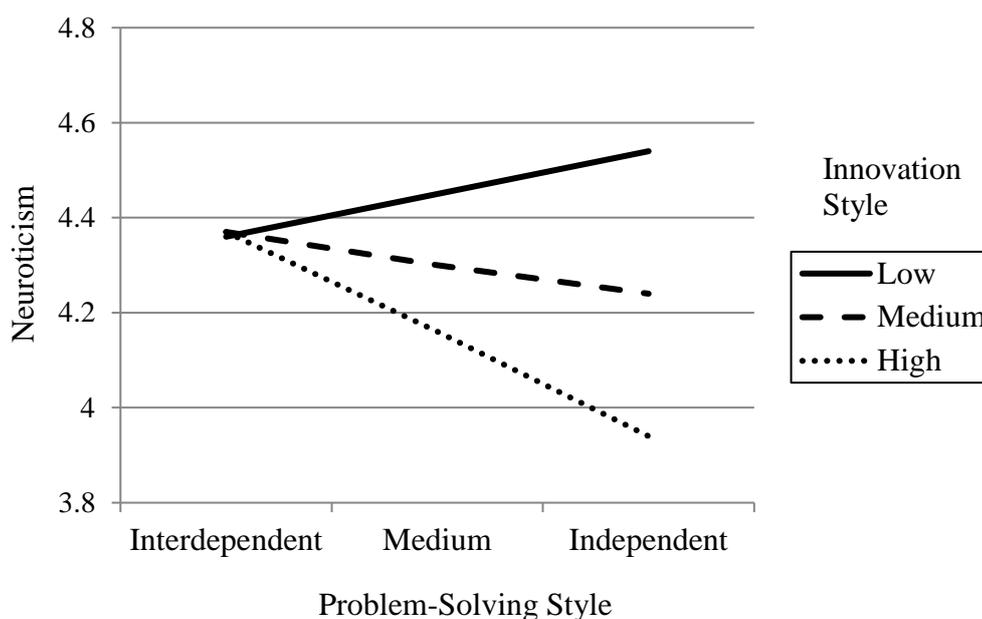


Figure 7.5. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of innovation style.

Indecisiveness. To test an alternative explanation for the moderating effect of openness, I examined whether problem-solving style and indecisiveness interacted to predict negative emotions. There was no interactive effect of problem-solving style and indecisiveness on any of the variables of negative emotions (ps ranged from .139 – .747). These null findings indicated that the moderating effect of openness could not be explained by participants' indecision to come to conclusions.

Discussion

Aim I: Testing the Psychometric Properties of the IIPSS

Similar to findings in the preceding Studies 1, 2, 3, and 4, the IIPSS showed a single factor structure and good internal consistency in the present study. Confirming the convergent validity of the IIPSS, the social personality traits of agreeableness and extraversion were negatively related to problem-solving style. In addition, perceived problem-solving efficacy and competence from self versus others showed positive relations with problem-solving style, and indecisiveness had a negative relation with problem-solving style. The IIPSS had non-significant correlations with the personality traits of openness, neuroticism, and conscientiousness, participants' need for cognitive closure, and measures of self-efficacy and self-esteem.

Contrary to predictions, the positive correlation between problem-solving style and the ability to achieve cognitive structure did not yield statistical significance. In addition, contrary to Studies 1 and 4, the relation between problem-solving style and social class was nonsignificant. Finally, contrary to Study 1, but consistent with Studies 2, 3, and 4, predicted gender differences regarding problem-solving style did not yield statistical significance.

I read participants' descriptions of their own or other people's problematic situations. Common problem situations revolved around balancing study, work, and

private life and family and relationship problems. I consider the novel findings of Study 5 in greater detail below and provide a broader overview of all five of my studies in the General Discussion chapter.

Need and ability for cognitive closure and problem-solving style.

Participants' need for cognitive closure is characterized by a personal need for arriving at conclusions quickly (Kruglanski & Webster, 1996). I assumed that a high need for closure was unrelated to participants' problem-solving styles because independent and interdependent problem-solving can serve people who feel the need to come to conclusions quickly. Independent problem-solvers could decide quickly by deciding on matters on their own, without considering other people's views. However, interdependent problem-solvers could fulfil their need for closure by drawing a conclusion with the help of others. In line with this assumption, participants' need for cognitive closure was not significantly correlated with problem-solving style.

The ability to achieve cognitive structure describes the cognitive ability to structure information (Bar-Tal, 1989). I assumed that the ability to achieve cognitive structure and problem-solving style would show a positive correlation because problem-solvers who structure information well would be more likely to make decisions on their own on a regular basis. However, although the correlation between the ability to achieve cognitive closure and problem-solving style was in the proposed direction, the correlation did not reach statistical significance ($r = .10, n = 235, p = .118$). It is possible that the current sample size was not sufficiently large to detect the small correlation between the variables. Schönbrodt and Perugini (2013) found that correlation coefficients stabilize in a sample of 250. Although the current sample is close to that number ($N = 235$), it is possible that the sample size of the current study was too small to detect a weak relation between the ability to achieve cognitive closure

and problem-solving style. Larger samples would offer a more fine-grained account of the relations between the variables under investigation.

Indecisiveness and problem-solving style. In the current study, participants' indecisiveness scores showed a weak but significant negative correlation with problem-solving style. This result indicated that undecided individuals tended to prefer asking other people for their opinions, presumably because undecided individuals were hesitant to come to conclusions on their own and therefore asked others to help them overcome their states of indecision. This finding was consistent with previous investigations (Ashby et al., 1966; Ferrari, 1994; Rochlen & O'Brien, 2002; Vertsberger & Gati, 2015). In particular, previous findings revealed that greater indecisiveness in everyday problem-solving situations was related to greater levels of dependence on other people (Ashby et al., 1966; Ferrari, 1994). In addition, students' proneness to seek help as a strategy to overcome career indecision was predicted by a general willingness to consult with others (Vertsberger & Gati, 2015). Thus, interdependence and indecisiveness have been shown to relate in a positive direction.

Self-efficacy and self-esteem and problem-solving style. In line with assumptions, none of the general self-efficacy and self-esteem measures showed significant correlations with problem-solving style. However, it seemed that an association between independent problem-solving and personal self-efficacy and competence appraisals was more likely to occur when the relative perceived efficacy and competence from oneself was contrasted with the perceived efficacy and competence of other people. In addition, problem-solving style was positively associated with participants' perceived risk of other people's solutions to problems being wrong, indicating that independent problem-solvers may tend to prefer solving problems by themselves because they are of the opinion that other people will not

provide adequate solutions to their problems. This result was somewhat similar to the negative relation between problem-solving style and help-seeking threat and avoidance observed in Study 4, which indicated that independent problem-solvers not only preferred to be self-sufficient, but also were reluctant to seek help. The current study indicated that one of the reasons that individuals preferred independent problem-solving over interdependent problem-solving might be because some independent problem-solvers perceived that they had better problem-solving resources compared to others. However, these correlations were only weak-to-moderate in magnitude, which supported overall assumptions made as part of the matching hypothesis, in that individuals might also choose problem-solving styles that contradict their efficacy appraisals.

Common problems experienced by participants. The most common problems reported by participants were problems involving studying, work, and interpersonal relationships. Participants either experienced those problems themselves, or observed these problems in people they knew, predominantly in friends, partners, and relatives. Because participants were undergraduate university students, problems involving finding a balance between university, work, and social commitments were commonly reported. In addition, although interpersonal problems have been reported to occur throughout the lifetime (Birditt, Fingerman, & Almeida, 2005; Strough, Berg, & Sansone, 1996), life transitions such as starting university can impact on interpersonal relationships, especially relationships with family members and peers that choose different life paths (Karataş, 2014; Lowenthal & Chiriboga, 1972; Wilcox et al., 2005). Mental and physical health problems were described to a lesser degree. These problem areas differed from those identified by Strough et al. (2002) who established a measure assessing everyday problem-solving preferences among older adults. In these samples,

health problems and problems involving everyday living were major concerns (Strough et al., 2002). In particular, Strough et al.'s measure described problems that were suitable for the elderly, such as memory problems, meal preparation problems, or transportation problems. However, none of the participants in the current study mentioned those problems. This is an indication that the IIPSS is not redundant with Strough et al.'s measure because the general nature of the IIPSS allows for comparisons of samples across the lifespan that identify different problem areas as relevant.

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Replicability of the moderating effect of openness. The current study constituted the first empirical investigation in which I conducted an a priori test of the moderating effect of openness. The interaction between openness and problem-solving style on neuroticism was replicated in the current data set. This finding supported my expectation that the moderating effect of openness was genuine, and not subject to multiple Type I errors. However, contrary to predictions, the conditional effect of problem-solving style on neuroticism at low levels of openness did not yield statistical significance ($p = .149$). Nonetheless, it showed the proposed positive association between problem-solving style and neuroticism, which confirmed the overall pattern of results. Consistent with Studies 1, 3, and 4, there was no significant effect of problem-solving style on neuroticism at medium levels of openness. Consistent with patterns in Study 1, problem-solving style was negatively correlated with neuroticism at high levels of openness. This pattern of results persisted after controlling for age and gender effects. Overall, the current findings demonstrated that the moderating of openness was replicable on an a priori basis.

Alternative measures of negative emotionality. In an attempt to clarify findings in Study 4, I examined whether state-based measures of negative emotionality were influenced by the moderating effect of openness. Consistent with the view that neuroticism shared common variance with other measures of negative emotionality (e.g., Beech, 2001; Engeli et al., 2014; Farmer et al., 2002; Goodwin & Hamilton, 2002; Lahey, 2009), neuroticism, depression, anxiety, stress, cognitive and somatic anxiety, and anxiety about solving problems had strong positive associations (r s ranged from .56 – .70).

In the current study, I expected that the interactive effect of openness and problem-solving style would also predict state-based accounts of stress, anxiety, depression, cognitive and somatic anxiety, and anxiety about solving problems. The interactive effect of openness and problem-solving style was only replicable on recent feelings of anxiety. Consistent with patterns of results in Study 4, there was a significant positive effect of problem-solving style on anxiety at low levels of openness. However, comparable to findings in Study 4, the interactive effect was influenced by extreme cases and covariations.

Contrary to findings in Study 4, openness did not interact with problem-solving style to predict recent feelings of stress and depression. Moreover, the interactive effect of problem-solving style and openness did not predict feelings of cognitive or somatic anxiety, or specific anxiety about solving problems. While the current study's reduced sample size ($N = 235$) in relation to the previous investigation ($N = 337$) could account for the inconsistencies observed between Studies 4 and 5, it seems that the moderating effect of openness is most pronounced in predicting trait-based negative emotions of neuroticism. This interpretation is similar to Nezu's (1986) observations, which showed that the interactive effect of poor problem-solving ability and stressful life events

accounted for a greater proportion of the overall variance of trait-based anxiety (52.2%) than state-based anxiety (24.9%).

A priori test of the matching hypothesis. In Chapter 3, I made assumptions regarding the process underlying the moderating effect of openness. In sighting previous literature on openness, I found that openness was related to cognitive abilities and positive problem-solving appraisals and behaviours (Chi & Glaser, 1985; DeYoung, 2014; DeYoung et al., 2014; Kaufman, 2013; Kaufman et al., 2010; Zillig et al., 2002). Hence, I assumed based on these previous findings that individuals high in openness would positively appraise their personal problem-solving abilities, and that individuals low in openness would appraise their personal problem-solving abilities poorly. I assumed that matches would occur when problem-solving style and openness were congruent (i.e., high openness and independence, and low openness and interdependence). I further assumed that mismatches would occur when problem-solving style and openness were incongruent (i.e., high openness and interdependence, and low openness and independence). I postulated that mismatches should result in higher levels of emotional distress relative to matches.

To examine whether the matching hypothesis would hold, I examined whether variables describing self-efficacy, problem-solving self-appraisals, and an innovative style to solving problems interacted with problem-solving style to predict negative emotions. In line with the matching hypothesis, general self-efficacy interacted with problem-solving style to predict participants' anxiety about solving problems, and participants' personal control appraisals interacted with problem-solving style to predict anxiety. In addition, innovation style and problem-solving style interacted to predict neuroticism. The patterns of results were comparable to the interactive effect of openness and problem-solving style on negative emotions. In support of the matching

hypothesis, the findings of the current study showed that at high levels of openness, general self-efficacy, and innovation style, interdependent problem-solvers experienced greater levels of negative emotions relative to independent problem-solvers. Also supporting the matching hypothesis, at low levels of personal control, independent problem-solvers experienced greater levels of negative emotions relative to interdependent problem-solvers. Overall, the present results indicated that high levels of openness, self-efficacy, and innovative problem-solving constituted a significant match with tendencies to solve problems alone, and low levels of personal control constituted a significant match with tendencies to solve problems with the help of others.

Testing an alternative explanation for the interaction effect. I also examined an alternative explanation for the moderating effect of openness based on previous findings indicating that openness to experience was negatively associated with indecisiveness (Bańka & Hauziński 2015; Lounsbury et al., 2005; Marcionetti, 2014). Greater levels of openness thus might facilitate decision-making particularly in independent problem-solvers compared to interdependent problem-solvers, because independent problem-solvers who do not hesitate to make decisions conclude the potentially stressful problem-solving process sooner than their interdependent counterparts. In contrast, lower levels of openness might slow down decision-making particularly in independent problem-solvers compared to interdependent problem-solvers, because independent problem-solvers who hesitate making decisions by themselves benefit from the help of other people. The alternative hypothesis stated that matches occurred when potentially distressing experiences of indecisiveness could be overcome in the best way relative to individuals' problem-solving styles (i.e., independent problem-solvers who are high in openness, and interdependent problem-

solvers who are low in openness), and mismatches occurred when indecisiveness was prolonged relative to individuals' problem-solving styles (i.e., interdependent problem-solvers who are high in openness, and independent problem-solvers who are low in openness).

The alternative hypothesis was not supported in the current study. There was no interactive effect between indecisiveness and problem-solving style in predicting measures of negative emotionality. Because there were moderating effects of self-efficacy, personal control, and creativity, but not of indecisiveness, the original matching hypothesis proposed in Chapter 3 appeared to be the superior explanation for the moderating effect of openness.

Another possible alternative explanation for the results is that individuals who are high in openness are also open to other people's ideas and thus show a mental health advantage when they solve problems on an interdependent basis. However, the results of the present thesis show the opposite pattern in that individuals high in openness reported reduced negative affectivity when they solved problems on an *independent* basis compared to an interdependent basis. Thus, the original matching hypothesis proposed in Chapter 3 explains the pattern of results more closely.

Limitations

Several limitations of the present investigation should be noted. First, the sample size of $N = 309$ participants, as suggested by an a priori power analysis, was not met in the current study (actual $N = 235$). Due to time constraints, I had to conclude the participant recruiting process prematurely. In addition, because the sample size was smaller than anticipated, mediation and mediated moderation effects could not be investigated because those more complex effects would require larger participant numbers. Furthermore, it is possible that inconsistencies between findings in this study

and my preceding studies, as well as unexpected null findings in the current study, were due to insufficient power to detect these small effects.

Second, in the present study, the moderating effect of openness was shown to influence only neuroticism and anxiety, but not other negative emotions. In addition, similar to Study 4, the moderating effect of openness on anxiety was weakened after controlling for outliers and covariates. There was no significant interaction effect between openness and problem-solving style on depression, stress, cognitive and somatic anxiety, and anxiety about solving problems. Consequently, the moderating effect of openness seemed to have a weaker or no effect on various state-based negative emotions.

Third, three of the self-generated items designed to assess participants' perceived quality of solutions available from themselves versus others showed poor internal consistency. Therefore, any interpretations regarding those variables needed to be made with caution.

Implications

Novel conclusions can be drawn from the present study that expand on the findings of the previous analyses presented in Chapters 3, 4, 5, and 6.

First, the current study provided novel associations with indecisiveness, perceived problem-solving efficacy and competence from self versus others, and participants' perceived risk of other people's solutions being wrong. In addition, problem-solving style was unrelated to the need for cognitive closure.

Second, the present study constituted the first a priori test of the moderating effect of openness. As predicted, the interactive effect of openness and problem-solving style on neuroticism yielded statistical significance. The present study confirmed

previous calculations regarding the low Type I error probability of the moderating effect of openness, suggesting that the observed interaction is indeed a true effect.

Finally, alternative measures for openness demonstrated that the moderating effect of openness seems to be related to cognitive abilities and positive appraisals of individuals' own problem-solving skills. Specifically, an innovative style to solving problems interacted with problem-solving style to predict neuroticism. In addition, general self-efficacy interacted with problem-solving style to predict anxiety about solving problems, and personal control appraisals interacted with problem-solving style to predict anxiety. Analyses of the conditional effects showed that, like openness, at low levels of general self-efficacy and innovation style, *independent* problem-solving was related to greater feelings of negative emotions. Also like openness, at high levels of personal control, *interdependent* problem-solving was related to greater feelings of negative emotions. These results supported assumptions made as part of the matching hypothesis, which stated that independent problem-solving constituted a mismatch at low levels of openness due to low problem-solving skill appraisals, and that independent problem-solving constituted a match at high levels of openness due to high problem-solving skill appraisals. Also supporting the assumptions put forward in the matching hypothesis, an alternative explanation regarding the negative relation between openness and indecisiveness could not be confirmed.

Overall, I concluded that the moderating effect of openness is a novel effect that differentiates under which conditions an independent or an interdependent problem-solving style leads to greater negative affectivity. An initial test of the influence of cognitive ability and personal problem-solving appraisals on the relation between problem-solving style and negative emotionality supported the assumptions I made as part of the matching hypothesis.

Chapter Eight: General Discussion

Overview

This chapter critically discusses the major findings of the present research. The present research investigated a novel measure of independent and interdependent preferences in everyday problem-solving situations. The unique feature of the IIPSS is that it assesses *general* problem-solving preferences that, unlike existing similar measures, are not context-specific and not restricted to stressful events. Therefore, the IIPSS can be utilized to compare problem-solving styles across a multitude of different situations and samples.

I begin this chapter by discussing major research findings relating to Aim I (i.e., the psychometric properties of the IIPSS) and Aim II (i.e., the conditional relation between problem-solving style and negative emotionality). In cases in which I tested an effect repeatedly, I also present results from an aggregate data analysis. This approach allows for judging the reliability of findings across multiple investigations. I then discuss the key contributions to previous literature and outline the general strengths and limitations of the research approach. I further discuss directions for future research and address the implications of the research findings as they relate to the general usefulness of the IIPSS and the theoretical and applied implications of the interactive effect between problem-solving style and openness on negative affectivity.

Discussion of the Outcomes Relating to Aim I and II

In the following section, I present a summary of findings across the five investigations of the current thesis in order to examine the replicability of results. In a subsequent section, I provide an in-depth discussion of the implications of these findings in the context of past work in the area.

According to Lishner (2015), aggregating the results of replication studies provides (a) higher statistical power and (b) more exact confidence interval estimates compared to individual results. Lishner argued that data aggregation techniques are preferable to meta-analytic approaches when complex relations such as moderator and mediator variables are under investigation. Because I examined those complex relations as part of my research Aim II, I chose to aggregate raw data to report overall pattern of results where applicable. As in previous chapters, I present the summary of findings separately for my two research aims.

Aim I: Testing the Psychometric Properties of the IIPSS

Factor structure and internal consistency. In Chapter 2, I presented previous investigations that examined the psychometric properties of the IIPSS (Rubin et al., 2012; Vieira, 2013). Rubin et al. (2012) found that Version 1 of the IIPSS had good internal consistency and a single factor structure. Vieira (2013) found acceptable internal consistency and, contrary to Rubin et al., a two-factor structure of Version 2 of the IIPSS. The present thesis expanded on these previous investigations. In each of the five investigations presented in the current research, the 10-item revised version of the IIPSS showed a single factor structure and good internal consistency. The single factor structure indicates that independent and interdependent problem-solving orientations constitute opposite poles of a continuum rather than two separate dimensions. The Cronbach's alpha coefficients of the IIPSS items ranged from .85 to .89, indicating that the revised scale items of Version 2 of the IIPSS were suitable to measure the underlying construct. As I explained in Chapter 3, factor analytical investigations are commonly not recommended in samples below 100 participants (Comrey & Lee, 1992; Gorsuch, 1983; Guadagnoli & Velicer 1988; Hatcher & Stepanski, 1994; Hutcheson &

Sofroniou, 1999; Kline 1994; Russell, 2002). Vieira's (2013) sample consisted of 79 participants, which might explain the discrepancy in findings.

Empirical publications have not yet been able to establish a clear picture on the dimensionality of constructs relating to independent and interdependent self-views. As mentioned previously, the IIPSS is conceptually related to the RISC scale (Cross et al., 2000). Initial investigations of the RISC scale yielded a single factor structure (Cross et al., 2000). However, several researchers have noted a two-factor structure for concepts of independence versus interdependence (e.g., Oyserman et al., 2002; Singelis, 1994; Trafimow, Triandis, & Goto, 1991; Triandis et al., 1986). In an attempt to shed light on this ambiguity, a recent meta-analysis by Taras et al. (2014) reviewed the dimensionality of common measures of individualism-collectivism (Hofstede, 1980), under which measures of relational-interdependent self-construal are subsumed. In particular, Taras et al. examined 149 research studies that employed psychometric scales assessing independence-interdependence or individualism-collectivism. Tara et al.'s results indicated that scales that were conceptualised to assess independence and interdependence as unidimensional fit a single factor structure better than scales that were conceptualised to assess independence and interdependence as two discrete dimensions. In addition, the authors found that more specific measures with a limited range of item domains, reference targets, and statement types suited a single factor structure better than more global measures with a greater range of item complexity. In line with Tara et al.'s findings, I argued that the underlying factor structure of the IIPSS is unidimensional because the IIPSS uses a unidimensional conception, as described previously. Also in line with Tara et al.'s findings, I argued that more specific measures that focus on particular issues like problem-solving styles should be conceived as unidimensional because the range of item complexity is limited. As mentioned in

Chapter 3, a measure like the IIPSS, which specifically contrasts preferences for independent versus interdependent problem-solving, does not allow for individuals to prefer both problem-solving styles because the two types are mutually exclusive. In contrast, I assumed that more global measures of self-construal have the flexibility to encompass seemingly opposite characteristics because global measures encompass a wide variety of different situations that include instances in which people adopt independent self-construal and instances in which people adopt interdependent self-construal.

In summary, in line with the conceptualisation of the IIPSS (Rubin, 2011c), a previous investigation on the factor structure on Version 1 of the IIPSS (Rubin et al., 2012) and factor-analytical tests in the current thesis revealed a one-factor structure for Version 2 of the IIPSS. Although empirical support for the factor structure of global measures of relational-interdependent self-construal remains ambiguous, conclusions drawn from recent meta-analytical investigations further support the assumption that the IIPSS has a single underlying factor structure.

Social class differences in problem-solving styles. Similar to research findings concerning the relation between social class and social reciprocity versus self-reliance (Bowman et al., 2009), the IIPSS showed a small but significant negative correlation with social class in Studies 1 and 4 ($r_s = -.15$ & $-.16$ respectively). Hence, participants who indicated that their social class was low scored higher on the IIPSS (i.e., reported more independent problem-solving) compared to participants who indicated that their social class was high. However, participants' social class was not significantly correlated with problem-solving style in Study 5 ($r = -.03$, $n = 229$, $p = .700$). An aggregate data analysis suggested that the overall negative relation between problem-solving style and social class across Studies 1, 4, and 5 was small but significant ($r = -$

.11, $n = 962$, $p = .002$). Hence, overall, the present research findings are consistent with prior work in the area (Bowman et al., 2009), and suggest that working-class people adopt a more independent problem-solving style than middle-class people. As Bowman et al. (2009) suggested, this social class difference may be due to differences in the ability to access resources. The authors assumed that working-class individuals would be socialized to be more self-reliant than middle-class individuals due to the relative scarcity of social and material resources. In contrast, middle-class individuals would be more likely to have the capacity to maintain social networks that are mutually supportive (see Bowman et al., 2009). Importantly, the present research demonstrates that this effect generalizes to a single measure of general problem-solving preference rather than the three separate measures of self-reliance, frequency of advice giving and receiving, and preference for receiving advice that Bowman et al. employed.

Gender differences in independence and interdependence. Previous research in the area of help-seeking found that women showed a greater willingness to seek help from others than did men (Day & Livingstone, 2003; Sen, 2004; Zimet et al., 1988). In addition, women had a greater tendency to view themselves with regard to their close relationships (Cross et al., 2000). Because the IIPSS was based on relational-interdependent self-construal theory, it was possible that women would prefer interdependent problem-solving more than men. An independent samples t test on the aggregated data generally supported this view. While men were significantly more independent ($M = 3.97$, $SD = 1.03$) than women ($M = 3.72$, $SD = 1.03$, $t(1,344) = -4.02$, $p < .001$), the Cohen's d effect size was only .22, which indicated a small effect (see Cohen, 1988).

Although the gender differences were less pronounced than expected, the current findings were similar to observations concerning everyday problem-solving (Strough et

al., 2002). Strough et al.'s (2002) general scale showed no gender differences between independent and interdependent problem-solving preferences among older adults. Interestingly, Hardie et al. (2006) did find significant gender effects only in interdependent but not in independent coping clusters. Specifically, Hardie et al. found that women preferred greater interdependent coping than men, but that men and women did not differ in their use of independent coping strategies. It is possible that gender differences were minimal in the current research because the IIPSS does not assess independence and interdependence separately.

Relations between problem-solving and extraversion and agreeableness.

Cross et al. (2000) found that relational-interdependent self-construal was positively associated with the social Big Five personality traits of extraversion and agreeableness. Supporting the convergent validity of Version 1 of the IIPSS, Rubin et al. (2012) found that problem-solving style was significantly and negatively related to extraversion. The present thesis also found additional evidence of the convergent validity of Version 2 of the IIPSS. In addition to extraversion, the interpersonal trait of agreeableness was also negatively correlated with problem-solving style, corroborating the importance of social orientation in interdependent problem-solving. An exception occurred in Study 2 because the negative correlation between the IIPSS and extraversion did not yield statistical significance ($r = -.10$, $n = 186$, $p = .168$). However, an examination of the aggregated data revealed that the overall negative correlations between problem-solving style and extraversion ($r = -.20$, $n = 1,356$, $p < .001$) and agreeableness ($r = -.21$, $n = 1,356$, $p < .001$) were weak-to-moderate and significant.

Relations between problem-solving style and self-construal and interpersonal measures.

In line with initial findings regarding Version 1 of the IIPSS (Rubin et al., 2012), Version 2 of the IIPSS had a moderate and negative correlation

with relational-interdependent self-construal ($r = -.37$) in Study 4. Also providing convergent validity for Version 2 of the IIPSS, Study 4 further revealed that problem-solving style had weak to strong negative associations with measures of help-seeking, collaboration in decision-making, and seeking social support coping (r s ranged between $-.15$ and $-.53$) and moderate positive associations with keeping to oneself, help-seeking threat, and help-seeking avoidance (r s ranged between $.32$ and $.34$). Hence, the current research presented novel evidence for the convergent validity of the revised version of the IIPSS.

The moderate correlation between the IIPSS and the RISC scale confirmed the convergent validity of the IIPSS, but also suggested that the IIPSS and the RISC scale do not contain redundant information. Apart from the different level of specificity described in the section on the factor structure of IIPSS, the IIPSS differs from the RISC scale in several other ways. As mentioned previously, the RISC scale describes to what extent the social context is integrated into individuals' self-views (see Cross et al., 2000; Cross et al., 2003). High scores on the RISC scale indicate greater relational-interdependent self-construal and low scores indicate greater independent self-construal. The IIPSS items contrast independence versus interdependence more explicitly. However, the most pronounced difference between the RISC scale and the IIPSS is that the IIPSS specifically refers to problem-solving situations, whereas the RISC scale focuses on self-views. Further supporting the distinctiveness between the two measures, there was no interaction effect between relational-interdependent self-construal and openness in predicting neuroticism in Study 4. However, the interaction effect between problem-solving style and openness in predicting neuroticism was significant in the same study, indicating that the unique reference to problem-solving situations added meaningful variance to the interaction effect over and above the

reference to relational-interdependent self-views. Therefore, the IIPSS contributes to existing measures of relational-interdependent self-construal in that the IIPSS contrasts independence and interdependence in problem-solving situations.

Relation between problem-solving style and indecisiveness. Similar to patterns found in the area of indecision among university students (Ashby et al., 1966; Ferrari, 1994; Rochlen & O'Brien, 2002; Vertsberger & Gati, 2015), problem-solving style showed a weak-to-moderate negative correlation with indecisiveness ($r = -.18$) in Study 5. These results indicated that interdependent problem-solvers tended to find it harder to come to conclusions relative to independent problem-solvers. In addition, results in Study 4 indicated that problem-solving was negatively correlated with instrumental activities to correct poor university performance ($r = -.23$) and problem-focused coping ($r = -.13$), indicating that interdependent problem-solvers use functional strategies to solve their problems. It is possible that some interdependent problem-solvers explore a multitude of ways for coming to conclusions, which includes focusing on the problem and asking others for help to overcome their levels of indecisiveness.

Relations between problem-solving style and openness and neuroticism and conscientiousness. Cross et al. (2000) found that relational-interdependent self-construal was unrelated to openness. Consistent with these findings, problem-solving style was not significantly related to openness in Studies 1, 2, 3, 4, and 5 (r s ranged from $-.04$ to $.05$), and aggregated data Pearson correlations showed that the overall correlation between problem-solving style and openness neared zero ($r = .04$, $n = 1,356$, $p = .146$). Hence, the current study supported the divergent validity of the IIPSS in that problem-solving style was unrelated to the cognitive Big Five personality trait of openness. Regarding the moderating effect of openness, the negligible correlation

further indicated that the two predictor variables could be treated as independent variables (see Tabachnick & Fidell, 1989).

Cross et al. (2000) further suggested that neuroticism was unrelated to relational-interdependent self-construal due to the emotional content of the neuroticism trait. In regards to problem-solving style, the IIPSS generally showed non-significant correlations with neuroticism. However, one exception occurred in Study 2, in which the IIPSS and neuroticism showed a small but significant positive correlation ($r = .16$, $n = 186$, $p = .029$). Pearson correlations on the aggregated data suggested that the IIPSS was unrelated to neuroticism ($r = .01$, $n = 1,356$, $p = .760$), thus confirming the divergent validity of the IIPSS.

The IIPSS showed no significant correlations with conscientiousness across studies ($r = -.01$, $n = 1,356$, $p = .841$). These results were in line with previous related findings in the area of support-seeking. In particular, Watson and Hubbard (2006) found that conscientiousness was unrelated to instrumental social support-seeking ($r = .03$). The recurrent null correlations between measures encompassing interdependent problem-solving orientation and conscientiousness support the notion that the respective instruments assess distinct underlying constructs.

Relations between problem-solving style and social desirability and demand characteristics. Further relating to the divergent validity of the IIPSS, I examined the relation between problem-solving style and social desirability in Studies 2 and 4. In both studies, the correlation coefficients of the relation between problem-solving style and the impression management subscale of the Balanced Inventory of Desirable Responding (Paulhus, 1991) approached zero ($rs = -.02$). These results indicated that the desire to give socially favourable responses was not confounded with responses to

the IIPSS. Hence, neither form of problem-solving was considered more socially desirable than the other.

I also examined the influence of demand characteristics in Studies 1, 2, 4, and 5. In Study 1, problem-solving style had a weak but significant negative correlation with the Perceived Awareness of the Research Hypothesis scale ($r = -.13$; Rubin et al., 2010), indicating that interdependent problem-solvers were more likely to believe that they were aware of the research hypotheses. In Studies 2, 4, and 5, this relation was in the positive direction but nonsignificant (r s ranged from .03 to .07). An aggregated analysis of the relation across studies showed a very small negative association between demand characteristics and problem-solving style that approached significance ($r = -.05$, $n = 1,157$, $p = .069$). While demand characteristics influenced the moderating effect of openness in Study 1, controlling for perceived awareness of the research hypothesis did generally not have any substantial effect on the pattern of results in the current research.

Relation between problem-solving style and problem-solving avoidance. As discussed in greater detail in Chapter 3, the unidimensional model of the IIPSS implies that independent and interdependent problem-solvers are motivated to solve their problems. To test the construct validity of the IIPSS, I examined in Study 4 whether problem-solving style was related to tendencies to avoid problems. For example, it would be possible that interdependent problem-solvers avoided problems by delegating their problems to other people. The results in Study 4 supported the divergent validity of the IIPSS in that the findings indicated that problem-solving style was not confounded with tendencies to avoid problems. In particular, there were no significant relations between problem-solving style and coping facets that encompass tendencies to avoid problems such as escape-avoidance, detachment, tension reduction, and wishful thinking (r s ranged from .03 to .08). In addition, results further suggested that problem-

solving style was not significantly related to strategies at university that could indicate problem-avoidance such as lowering aspirations and changing career goals in response to poor academic outcomes ($r_s = .02$ & $.07$ respectively). The divergent validity with problem-solving avoidance was in line with Hardie et al.'s (2006) findings on independent and relational coping styles. In Hardie et al.'s study, neither independent nor relational coping clusters were significantly associated with avoidance coping (such as alcohol or drug use and turning to religion).

Relation between problem-solving style and need and ability for closure. In Study 5, I examined whether problem-solving style was related to the need and ability for cognitive closure (Bar-Tal, 1989; Webster & Kruglanski, 1994). I expected that problem-solving style was unrelated to the need for cognitive closure because both independent and interdependent problem-solving orientations can be utilized in a way that enables individuals with a high need for closure to come to solutions quickly. However, I assumed that individuals who expressed a greater cognitive ability to organize information were more likely to prefer independent problem-solving because individuals who can organise information efficiently reach conclusions effectively on their own and, thus, feel no need to seek for help. In line with predictions, participants' need for cognitive closure was not significantly related to problem-solving style ($r = .01$), indicating that feeling pressed to come to conclusions was unrelated to solving problems independently or with the help of others. However, results concerning the relation between problem-solving style and the *ability to achieve* cognitive closure did not support the hypothesis. Specifically, although results confirmed my assumptions that problem-solving style was positively related to the ability to achieve cognitive closure, the correlation did not yield statistical significance ($r = .10, n = 235, p = .118$). Therefore, findings in Study 5 indicated that problem-solving style was largely

unrelated to concepts of need and ability for cognitive closure. Larger samples might be sensitive enough to capture more subtle relations between problem-solving style and the ability for cognitive closure.

Relations between problem-solving style and self-esteem and self-efficacy.

Similar to findings regarding relational-interdependent self-construal and global self-esteem (Cross et al., 2000; Cross et al., 2002), problem-solving style was not significantly related to global self-esteem in Study 4 ($r = -.10$, $n = 337$, $p = .168$). In Study 5, I examined whether the two proposed facets of global self-esteem, namely self-liking and self-competence (see Tatarodi & Milne, 2002; Tatarodi & Swann, 1995; 2011), would reveal a more nuanced understanding of the relation between problem-solving style and self-esteem. There was a negative but non-significant relation between self-liking and problem-solving style ($r = -.07$, $n = 235$, $p = .300$) in Study 5. In contrast, Study 5 also revealed that there was a positive relation between self-competence and problem-solving style that approached significance ($r = .12$, $n = 235$, $p = .059$). Although this relation did not reach statistical significance, the findings suggested that a more fine-grained approach to investigating self-esteem differences in independent and interdependent problem-solvers would be generally indicated.

In Study 5, general measures of self-efficacy such as general self-efficacy, problem-solving confidence, and personal control were positively related to problem-solving style (r s ranged between .10 and .12). However, these correlations did not reach statistical significance (p s ranged between .071 and .121). In contrast, a self-generated measure that was designed to contrast perceived efficacy and competence from oneself versus perceived efficacy and competence from others showed a moderate positive correlation with problem-solving style ($r = .27$), indicating that independent problem-solvers tended to believe that their problem-solving abilities were superior

compared to those of other people. In addition, problem-solving style correlated positively with participants' perceived risk of other people's solutions being wrong ($r = .30$), indicating that independent problem-solvers tended to feel that the solutions provided by others could be faulty. Hence, it is possible that independent and interdependent problem-solvers generally do not differ in their levels of self-efficacy, but that independent problem-solvers tend to prefer their own problem-solving approaches over those of other people. It needs to be noted, though, that results regarding the self-generated scales need to be interpreted with caution because the measures lacked adequate internal consistency (Cronbach's $\alpha = .68$ & $.59$ respectively).

Criterion-related validity of the IIPSS. Investigations of the criterion-related validity of the IIPSS in Study 4 confirmed that university students who had an interdependent problem-solving style reported engaging in interdependent problem-solving behaviours in the weeks prior to their research participation. In particular, two interdependent problem-solving behaviours - "asked another student" and "asked a tutor or lecturer" - were significantly and negatively related to problem-solving style ($r_s = -.30$ & $-.19$ respectively). However, contrary to expectations, the remaining four problem-solving behaviours were not significantly related to problem-solving style (r_s ranged between $-.09$ and $.01$). It should also be critically noted that the present test of criterion-related validity was based on self-report alone and did not measure observed behaviour. Future research needs to address the criterion-related validity of the IIPSS with the use of objective criteria for independent and interdependent problem-solving behaviours.

Test-retest reliability of the IIPSS. Confirming the stability of the IIPSS, the measure showed adequate test-retest reliability with a correlation coefficient of $.79$ across two time points that were between 4 and 12 months apart. This outcome was in

line with expectations because problem-solving style is conceptualized as a person-based tendency that remains relatively stable over time (Rubin, 2011c), but that can be influenced by changing life circumstances such as entering university.

General preferences for independence and interdependence across samples.

To test whether participants preferred independent or interdependent problem-solving, I examined participants' mean scores on the IIPSS. Table 8.1 shows the participant numbers, means and standard deviations of the IIPSS, and *t* test statistics for Studies 1, 2, 3, 4, and 5. Using one sample *t* tests, I examined whether the sample means differed significantly from the midpoint of the scale. Only the academic sample (Study 3) had a mean above the midpoint of 4. Therefore, only academics tended to be greater independent problem-solvers, whereas the student participants in Studies 1, 2, 3, and 5 tended to be greater interdependent problem-solvers. However, one sample *t* tests indicated that only the student samples were significantly more interdependent (*p*s ranged between $< .001$ and $.030$), whereas the independent problem-solving preference of the research academics did not yield statistical significance ($p = .124$).

Interestingly, in Strough et al.'s (2002) investigation on everyday preferences for independent and interdependent problem-solving, the authors found that older adults preferred to solve problems alone. This finding is in contrast to examinations in student samples of the present thesis. To test the possibility that individuals prefer greater independent problem-solving style with age, I assessed the correlation between problem-solving style and the log-transformed age variable in the aggregated data set. There was a weak positive association between problem-solving style and age ($r = .16$, $n = 1,339$, $p < .001$), indicating that older adults tended to be more independent problem-solvers. Therefore, the present findings suggested that preferences for

independence or interdependence in problem-solving situations seem to change with different cohorts and segments of society.

Table 8.1

One sample t tests indicating whether participants were more independent ($M_s > 4$) or more interdependent ($M_s < 4$) in Studies 1 – 5

Study No.	<i>n</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>df</i>	<i>Sig.</i>
Study 1	399	3.68	1.04	-6.19	398	< .001
Study 2	186	3.85	.96	-2.19	185	.030
Study 3	198	4.11	.99	1.54	197	.124
Study 4	337	3.82	1.08	-3.04	336	.003
Study 5	235	3.62	1.01	-5.79	234	< .001

Aim II: The Conditional Relation between Problem-Solving Style and Negative Emotionality

Replicability of the moderating effect of openness. In the current thesis, I demonstrated the replicability of the interactive effect of problem-solving style and openness on neuroticism. The moderating effect of openness was statistically significant in Studies 1, 2, 4 and 5, but only approached significance in Study 3 ($p = .097$). According to the matching hypothesis, I expected a positive correlation between problem-solving style and neuroticism at low levels of openness and a negative relation between problem-solving style and neuroticism at high levels of openness. The proposed positive effect of problem-solving style on neuroticism at low levels of openness was significant in Studies 1, 2, and 4 but not in Study 3 ($p = .147$), although the trend was in the predicted direction. The proposed negative effect of problem-solving style on neuroticism at high levels of openness was only significant in Study 1 and not in Studies 2, 3, and 4 (p s ranged between .220 and .730). In Studies 2 and 3, the

trends were in the predicted direction, but not in Study 2 ($b = .04$, $SE = .11$, $t = .35$, $p = .730$). Out of the five investigations of the current research, Study 1 had the largest sample size ($N = 399$) and Study 2 had the smallest sample size ($N = 186$). Therefore, it is possible that the smaller samples lacked power to detect the full interaction effect observed in Study 1 and that, consequently, an aggregate data analysis may provide a more sensitive test.

Using Model 1 of Hayes' (2013) PROCESS software, I conducted an aggregate data analysis to test the overall interaction between openness and problem-solving style on neuroticism across Studies 1, 2, 3, 4, and 5 ($N = 1,352$). There was a significant effect of openness on neuroticism when problem-solving was at the sample mean, $b = -.21$, $SE = .04$, $t = -5.59$, $p < .001$, 95% CI $[-.28, -.13]$, but no significant effect of problem-solving style on neuroticism when openness was at the sample mean, $b = .02$, $SE = .03$, $t = .73$, $p = .468$, 95% CI $[-.04, .09]$. Critically, there was a significant interaction between problem-solving style and openness in predicting neuroticism, $b = -.19$, $SE = .03$, $t = -5.56$, $p < .001$, 95% CI $[-.25, -.12]$, indicating that the effect of problem-solving style on neuroticism was linearly dependent on openness.

Figure 8.1 illustrates the conditional effects of problem-solving style on neuroticism at low ($-1 SD$), medium (M), and high ($+1 SD$) values of openness. At low levels of openness, there was a highly significant positive relation between problem-solving style and neuroticism, $b = .19$, $SE = .05$, $t = 4.29$, $p < .001$, 95% CI $[.10, .28]$. At medium levels of openness, the relation between problem-solving and neuroticism was nonsignificant, $b = .02$, $SE = .03$, $t = .73$, $p = .467$, 95% CI $[-.04, .09]$. Similar to findings in Studies 1 and 5, at high levels of openness, problem-solving style was negatively correlated with neuroticism, $b = -.15$, $SE = .04$, $t = -3.35$, $p = .001$, 95% CI $[-$

.23, -.06]. The pattern of results persisted after excluding univariate and multivariate outliers.

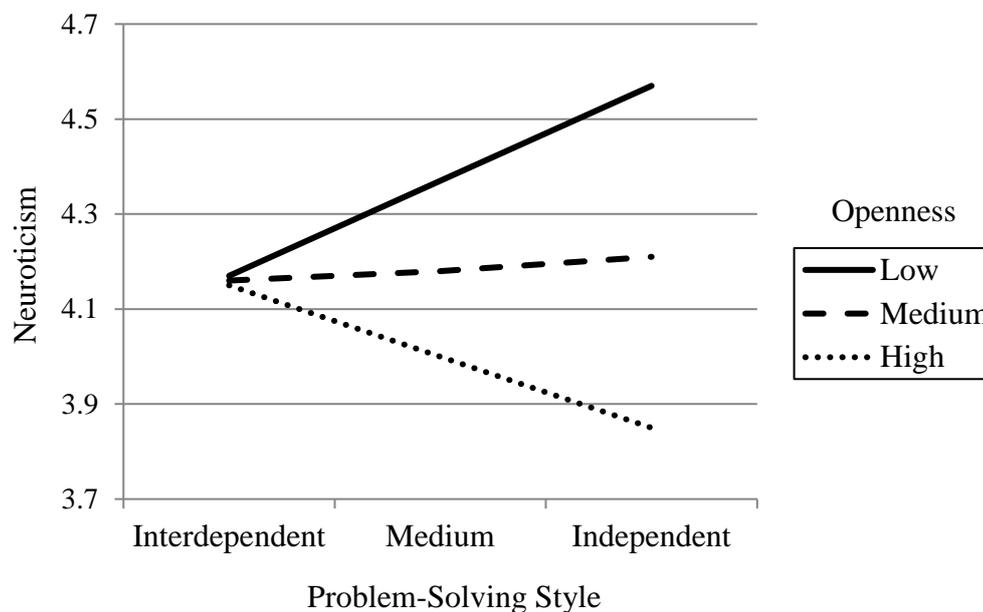


Figure 8.1. Conditional effects of problem-solving style on neuroticism among participants with low ($-1 SD$), medium (M), and high levels ($+1 SD$) of openness across five studies.

Thus, although the conditional effects at high and low levels of openness were not significant in all of the five investigations, the analysis of the combined data sets revealed that the conditional effects at high and low levels of openness were significant. This result of the aggregate data analysis supported the matching hypothesis in that there would be a change in direction of the correlation between problem-solving style and negative emotionality at high and low levels of openness.

The moderating effects of positive problem-solving appraisals. Further supporting assumptions made as part of the matching hypothesis, various appraisals of personal problem-solving ability, self-efficacy, and innovative problem-solving were significant moderators of the problem-solving style-neuroticism relation. In Study 3, I

found corroboratory evidence showing that academics' ratios of single-authored publications compared to their multi-authored publications (i.e., indications for academics' independent publication experience) interacted with problem-solving style to predict neuroticism. I also found in Study 3 that academics' subjective performance ratings (i.e., indications for academics' occupational self-efficacy) interacted with problem-solving style to predict neuroticism. In line with patterns of the moderating effect of openness, problem-solving style positively predicted neuroticism when academics' single- versus multi-authored publication ratios were low. Also in line with patterns of the moderating effect of openness, problem-solving style positively predicted neuroticism when academics' subjective performance ratings were low. Thus, findings in Study 3 revealed that independent problem-solving among academic researchers only led to greater neuroticism when their levels of openness, independent problem-solving experience, and personal performance ratings were low. These results supported my assumptions put forward in the matching hypothesis in that openness interacted with problem-solving style to predict negative emotions because openness is associated with self-appraised problem-solving skill (Bouchard, 2003; Hartman & Betz, 2007; McMurrin et al., 2001; Moberg, 2001; Nauta, 2004; Penley & Tomaka, 2002; Rottinghaus et al., 2002).

Also in accordance with the matching hypothesis, trends of results in Study 5 indicated that personal control appraisals interacted with problem-solving style to predict anxiety. The personal control subscale of the Problem Solving Inventory (Heppner & Peterson, 1982) refers to "believing one is in control of one's emotions and behaviors while solving problems" (Heppner et al., 2004, p. 353). Study 5 indicated that personal control appraisals had joint effects with problem-solving style to predict participants' levels of anxiety. In particular, conditional effects revealed that problem-

solving style showed a positive correlation with anxiety at low levels of personal control appraisals. This trend of results was comparable to the positive relation between problem-solving style and negative emotions when openness was low. In addition, this pattern of results was in line with previous investigations in the area of personal problem-solving, indicating that concerns regarding one's own problem-solving capabilities predicted negative emotional consequences (for an overview, see Heppner et al., 2004). It needs to be noted, however, that the interaction between personal control and problem-solving style only approached significance ($p = .062$). Consequently, the aforementioned findings need to be interpreted with caution.

Further in line with assumptions made as part of the matching hypothesis, general self-efficacy and an innovative style to solving problems interacted with problem-solving style to predict negative emotions in Study 5. In particular, at high levels of general self-efficacy, problem-solving style showed negative correlations with anxiety about solving problems. Similarly, at high levels of innovation style, problem-solving style showed negative correlations with neuroticism. These pattern of results were comparable with the negative relation between problem-solving style and negative emotions at high levels of openness and thus supported my assumptions that the moderating effect of openness could be explained in terms of the positive relations between openness and variables measuring self-efficacy and cognitive ability (Chi & Glaser, 1985; DeYoung, 2014; DeYoung et al., 2014; Kaufman, 2013; Kaufman et al., 2010; Zillig et al., 2002).

Alternative measures of problem-solving style. My research also sought to confirm that the moderating effect of openness on the relation between problem-solving style and neuroticism was not restricted to the specific measure of problem-solving style that I had focused on (i.e., the IIPSS). Demonstrating that the moderating effect of

openness was not restricted to the IIPSS measure, seeking social support coping and openness interacted to predict neuroticism in Study 4. Comparable with findings using the IIPSS, seeking social support coping (i.e., interdependent problem-solving) negatively predicted neuroticism when openness was low. Also in line with findings using the IIPSS, seeking social support coping positively predicted neuroticism when openness was high.

Alternative measures of negative emotionality and the mediating role of stress and anxiety. Given that some researchers might consider it inappropriate to treat neuroticism as an outcome variable, it was also important to demonstrate that the moderating effect of openness predicted state-based levels of negative emotions. In Study 4, the interactive effect of openness and problem-solving style predicted recent feelings of stress, anxiety, and depression. In addition, stress and anxiety mediated the interactive effect of openness and problem-solving style on neuroticism, indicating that state-based levels of stress and anxiety indirectly affected the moderating effect of openness. In Study 5, the interactive effect of openness and problem-solving style was only replicated on anxiety. These relations, however, were subject to influences of outliers and covariations.

Importantly, an aggregate analysis showed that the moderating effect of openness significantly predicted state-based levels of depression, anxiety, and stress across Studies 4 and 5 (p s ranged from .005 and .014; $ns = 572$). At low levels of openness, problem-solving style positively predicted levels of depression, anxiety, and stress (p s were $\leq .001$). At medium levels of openness, problem-solving style also positively predicted levels of depression and stress (p s $< .001$ and .006 respectively) and marginally on anxiety ($p = .051$). Finally, at high levels of openness, problem-solving style did not predict levels of depression, anxiety, and stress (p s ranged from .181 and

.714). The nonsignificant findings at high levels of openness were in contrast to a significant negative relation between problem-solving style and neuroticism at low levels of openness, indicating that state-based negative emotions are influential at low levels of openness but not at high levels of openness. Similar to Studies 4 and 5, the interactive effect of openness and problem-solving style on anxiety was influenced by outliers and age and gender effects in the aggregated sample ($p = .05$).

Comparable to findings in Study 4, the aggregate analysis across Studies 4 and 5 showed that stress and anxiety significantly mediated the interaction effect between openness and problem-solving style on trait-based levels of negative emotions (i.e., neuroticism). A mediated moderation analysis using Model 8 of Hayes' (2013) PROCESS software with 5,000 bootstrapping iterations revealed that the indirect effects of the problem-solving style by openness interaction on neuroticism via stress and anxiety were significant, $b = -.05$, bootstrapped $SE = .02$, 95% CI $[-.09, -.01]$ for stress and $b = -.03$, bootstrapped $SE = .01$, 95% CI $[-.09, -.01]$ for anxiety. Similar to findings in Study 4, the indirect effect of the problem-solving by openness interaction on neuroticism via depression was not significant, $b = -.01$, bootstrapped $SE = .01$, 95% CI $[-.04, .00]$. Conditional mediating effects of stress and anxiety showed that stress and anxiety only mediated the effect of problem-solving style on neuroticism at low levels of openness ($b = .10$, bootstrapped $SE = .03$, 95% CI $[.04, .17]$ for stress and $b = .05$, bootstrapped $SE = .02$, 95% CI $[.02, .10]$ for anxiety) and medium levels of openness ($b = .05$, bootstrapped $SE = .02$, 95% CI $[.02, .10]$ for stress and $b = .02$, bootstrapped $SE = .01$, 95% CI $[.00, .05]$ for anxiety), but not at high levels of openness ($b = .01$, bootstrapped $SE = .03$, 95% CI $[-.04, .06]$ for stress and $b = -.01$, bootstrapped $SE = .01$, 95% CI $[-.04, .02]$ for anxiety). In Study 4, only stress was robust against the effect of outliers and statistical controls. In the aggregate sample, however, both stress and

anxiety remained significant mediators of the interaction effect after the exclusion of outliers and adding age and gender as control variables.

Taken together, results from aggregated data analyses showed that problem-solving style predicted state-based levels of depression, anxiety, and stress at low and medium levels of openness, but not at high levels of openness. In addition, state-based levels of stress and anxiety mediated the effect of problem-solving style on neuroticism at low and medium levels of openness, but not at high levels of openness. These results add to our understanding by showing that recent feelings of negative emotions help explain the predictiveness of independent problem-solving on chronic feelings of negative emotions (i.e., neuroticism). However, the current findings also indicate that recent feelings of negative emotions cannot explain the predictiveness of problem-solving style on chronic feelings of negative emotions at high levels of openness. Therefore, what remains unclear is why interdependent problem-solvers who are high in openness feel greater levels of chronic negative emotions when they do not experience increased levels of state-based negative emotions relative to independent problem-solvers. Hence, future research in this area should work to identify which variables mediate the relation between problem-solving style and neuroticism at high levels of openness.

Does the moderating effect of openness influence mental health and performance? The matching hypothesis does not specify how the relation between openness and problem-solving style affects actual performance. To test this relation, I examined the interactive effect of openness and problem-solving style on various academic and creative performance indices in Studies 1, 2, and 3, but did not find any significant results. In particular, in Study 1, the joint effect of openness and problem-solving style did not yield statistically significant results in predicting first year

students' cumulative weighted average marks, grade point average marks, and course marks (ps ranged between .162 and .858). In Study 2, the joint effect of openness and problem-solving style did not yield statistically significant results in predicting participants' creative and estimation task performances (ps ranged between .167 and .890). Finally, in Study 3, only academics' ratio of single- versus multi-authored publications and academics' subjective performance ratings interacted with problem-solving style to predict neuroticism. The joint effect of openness and problem-solving style did not yield statistically significant results in predicting academics' h index, eigenfactor and article influence scores of recent journal publications, academic positions held at university, and university prestige (ps ranged between .065 and .858). Thus, the relation between openness and problem-solving style seems to be largely connected to psychological outcomes, rather than objective performance outcomes. This observation is similar to previous meta-analytic findings that did not identify openness as a meaningful predictor for job performance (rs ranged between -.02 and .06; Barrick, Mount, & Judge, 2001; Barrick & Mount, 1991; Saldago, 1997; see also Griffin & Hesketh, 2004 for a discussion). This overall pattern of results implies that, while the interactive effect of problem-solving style and openness predict mental health outcomes, this relation cannot be generalized to objective performance outcomes. The current findings are in line with the conceptualisation of personal problem-solving put forward by Heppner and Krauskopf (1987) in that people's real-life problem-solving processes do not necessarily result in problem-solving effectiveness.

In contrast to the limited relation between openness and performance (Barrick, et al., 2001; Barrick & Mount, 1991; Saldago, 1997), openness has been found to have cognitive, affective, and physiological functions that alleviate negative emotions (Bouchard, 2003; DeYoung, 2014; DeYoung et al., 2014; Kaufman, 2013; Kaufman et

al., 2010; McMurrin et al., 2001; Moberg, 2001; Oswald et al., 2006; Schneider et al., 2012; Spink et al., 2014; Williams, Rau, Cribbet, & Gunn, 2009). For example, Spink et al. (2014) investigated the relationship between neuroticism, openness to experience, and modern health concerns (e.g., hormones in food) among American students. Spink et al. found that openness moderated the relation between neuroticism and modern health concerns in that neuroticism was only related to modern health concerns when openness was low or medium. When openness was high, neuroticism showed no relationship with modern health concerns. To explain the findings, Spink et al. referred to Williams et al.'s (2009) investigations on the stress-buffering effects of openness to experience. Williams et al. conducted research showing that individuals with high levels of openness showed resilience following stressful events concerning a variety of physiological and affective markers, such as better sleep quality, less blood pressure reactivity, and more positive affect than individuals lower in openness. In his article on the openness trait, DeYoung (2014) argued that the stress-relieving effect of openness could be explained in terms of the protective effects of cognitive exploration. In particular, aspects of cognitive exploration (e.g., writing down emotional and traumatic experiences) were correlated with better long-term stress-regulation and physiological health in both traumatized and student populations (Pennebaker, 1997). Thus, openness seems to influence various intraindividual processes that affect psychological adjustment.

In summary, while openness has been found to be largely unrelated to performance (Barrick, et al., 2001; Barrick & Mount, 1991; Saldago, 1997), openness has been shown to buffer stress-related outcomes through cognitive, affective, and physiological mechanisms (e.g., DeYoung, 2014; Oswald et al., 2006; Schneider et al., 2012; Spink et al., 2014; Williams et al., 2009). These mechanisms seem to be general

indicators of healthy psychological functioning (Oswald et al., 2006), and thus may protect from negative emotional effects during times of personal problem-solving efforts. This stress-alleviating effect of openness to experience could help explain (a) why the joint effect of problem-solving style and openness is predictive of mental health outcomes rather than performance outcomes, and (b) why independent and interdependent problem-solvers who were high in openness had lower scores in neuroticism relative to independent and interdependent problem-solvers who were low in openness (see Figure 8.1).

Relation to Rubin et al.'s research. I discuss in the present section how the moderating effect of openness relates to a previous investigation in which the IIPSS was selected as a moderator variable (Rubin et al., 2012). As mentioned in Chapter 1, Rubin et al. (2012) investigated the relation between problem-solving style and approach-avoidance motivation in predicting social integration outcomes among Australian immigrants. The authors found that problem-solving style moderated the relation between immigrants' approach motivation and their levels of social integration into the host country. Specifically, only at high levels of problem-solving style (i.e., independent problem-solving), an approach orientation positively predicted social integration. At low levels of problem-solving style (i.e., interdependent problem-solving), the relation between approach orientation and social integration was not significant. To explain their findings, Rubin et al. stated, "interdependent problem-solvers rely on other people to help them with the task of social integration, and this interdependence reduces the influence of their approach-avoidance orientation on the outcome of the task" (p. 504). A similar process may be at play in the current research. If the pattern of results found in Rubin et al.'s research is applicable to the current research, openness should negatively predict negative emotions among independent

problem-solvers, but there should be no relation between openness and negative emotions among interdependent problem-solvers.

To compare the pattern of results of the present thesis and Rubin et al.'s findings, I selected problem-solving style as the moderator variable and openness as the independent variable to predict neuroticism. Figure 8.2 illustrates the moderating effect of problem-solving style on the relation between openness and neuroticism in the aggregated data set. In line with expectations, conditional effects showed that openness negatively predicted neuroticism at medium ($b = -.21$, $SE = .04$, $t = -5.59$, $p < .001$, 95% CI $[-.28, -.13]$) and high levels ($b = -.40$, $SE = .05$, $t = -8.32$, $p < .001$, 95% CI $[-.49, -.30]$) of problem-solving style (i.e., independent problem-solving). Also in line with expectations, openness did not predict neuroticism at low levels of problem-solving style (i.e., interdependent problem-solving; $b = -.01$, $SE = .05$, $t = -.24$, $p = .808$, 95% CI $[-.12, .09]$).

Therefore, the present findings are compatible with Rubin et al.'s (2012) interpretation in that the predictability of openness on emotional outcomes is enhanced among individuals who choose to solve problems alone. Among problem-solvers who tend to consult with others to solve their problem, the predictability of openness on negative emotions diminishes. Further supporting this view, Figure 8.1 indicates that the mean differences in neuroticism scores at high and low levels of openness are more pronounced for independent problem-solvers than for interdependent problem-solvers. Thus, it seemed that Rubin et al.'s explanations concerning the moderating effect of problem-solving style would not only be applicable to the area of social integration, but also to the area of mental health.

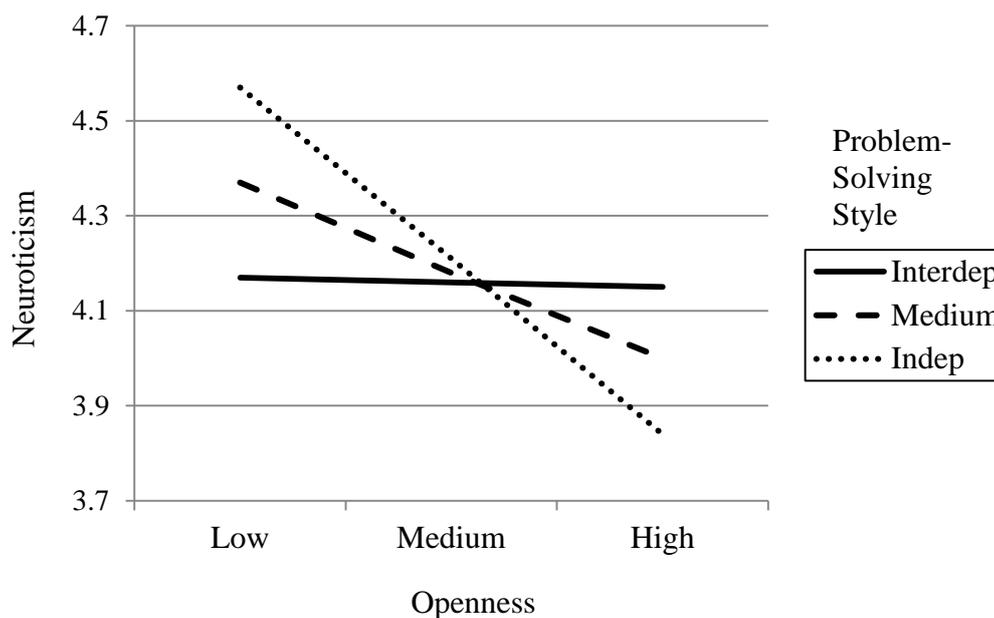


Figure 8.2. Conditional effects of openness on neuroticism among interdependent ($-1 SD$), medium (M), and independent ($+1 SD$) problem-solvers across five studies.

In the present thesis, I selected problem-solving style as the independent variable to assess the effect of problem-solving style on negative emotionality as a function of openness. The reason for this approach was that openness has been found to relate to various concepts that are relevant to functional personal problem-solving processes such as cognitive ability, positive problem-solving approaches, and self-efficacy (Chi & Glaser, 1985; Bouchard, 2003; DeYoung, 2014; DeYoung et al., 2014; Hartman & Betz, 2007; Kaufman, 2013; Kaufman et al., 2010; McMurrin et al., 2001; Moberg, 2001; Nauta, 2004; Penley & Tomaka, 2002; Rottinghaus et al., 2002; Zillig et al., 2002). In addition, various forms of independent and interdependent problem-solving have been found to predict negative emotions (e.g., Hardie et al., 2006; Ko et al., 2005; Link & Phelan, 2006; McMurrin et al., 2001), yet research contrasting independent versus interdependent problem-solving were typically more concerned with

problem-solving effectiveness than with mental health outcomes (e.g., Meegan & Berg, 2002; Patrick & Strough, 2004; Strough et al., 2002). Relating to Rubin et al.'s (2012) approach, I found it more appropriate to postulate that openness affects when independent or interdependent problem-solving predicts greater negative emotional outcomes in order to clarify under which conditions independence versus interdependence had more negative emotional effects. However, considering the alternative research design by Rubin et al., it is also possible to regard problem-solving style as the moderator variable and openness as the independent variable. In this case, the stress-relieving effect of openness to experience can only be detected in independent problem-solvers but not in interdependent problem-solvers because taking on board other people's advice diminishes the predictability of one's own level of openness. The decision as to which variables to choose as the independent and moderator variables depends on the specific research interests and on theoretical considerations. As I demonstrated in the comparison of the current research design and Rubin et al.'s investigation, different approaches in variable selection seem to complement each other rather than produce conflicting results.

Strength and Limitations of the Current Research

Strength

Demonstrating the replicability of findings. One significant strength of the current study was that numerous novel results relating to my research Aims I and II were tested for their replicability. For example, I tested the factor structure of the IIPSS, as well as gender and social class differences in problem-solving style repeatedly in order to examine the reliability of the current findings. This approach was in line with principles on best practice in research (see Roediger, 2012). It was particularly important to test the replicability of findings in regards to the moderating effect of

openness because I identified the interaction effect on an exploratory basis. Following common recommendations on replication studies in psychology (e.g., Kerr, 1998; Lishner, 2015; Murayama et al., 2014, Schmidt, 2009), I conducted both direct and conceptual replications of the moderating effect openness and provided corroboratory evidence for the interaction effect. For example, I tested for the replicability of the moderating effect of openness in similar student samples, but I also extended my replication analyses to a different sample comprised of academic researchers. I further tested for the replicability of the moderating effect of openness using the same measures as in Study 1, but I also employed a short form of the BFI and alternative measures of problem-solving style and negative emotionality to extend on the direct replicability of the effect. I also tested for corroboratory evidence of the moderating effect of openness by testing the significance of interactions between problem-solving style and measures of problem-solving confidence and innovative problem-solving. Thus, the novel research findings presented in the current thesis have been shown to be relatively robust across multiple samples, investigations, and measurement instruments.

Identifying conditions under which independence or interdependence predict greater negative emotionality. Another significant strength of the current study was that I presented novel findings that identify the conditions under which independence and interdependence predicted greater levels of negative emotions. In a previous investigation, Hardie et al. (2006) regarded independent, interdependent, and collective coping as orthogonal constructs. The authors found that greater self-coping complexity (i.e., having an independent, interdependent, and collective coping style) facilitated well-being as opposed to restricted self-coping patterns (i.e., coping only in an independent, interdependent, or collective manner). In contrast to their examination, the current research was specifically interested in contrasting independent and

interdependent problem-solving in order to test under which circumstances preferences for independent or interdependent problem-solving had greater mental health implications. Thus, in line with recommendations in the area of problem-solving appraisal (see Heppner et al., 2004), I was looking to examine complex relations between individual differences in everyday problem-solving approaches and psychological adjustment in order to contribute to the current research on the mental health impact of everyday problem-solving preferences.

I found that openness to experience, self-efficacy, personal control, and an innovative style to solving problems all moderated the relation between problem-solving style and negative emotionality. Importantly, the Big Five personality traits of agreeableness, extraversion, and conscientiousness did not interact with problem-solving style to predict negative emotions (ps ranged between .130 and .557 in an aggregated data set of $ns = 1,356$). Therefore, the present research indicated that only the cognitive personality trait of openness and its related constructs of self-efficacy, personal control appraisal, and innovation style were able to predict when independence or interdependence in problem-solving situations had greater mental health implications.

Limitations

A posteriori analyses. A notable limitation of the current research program is that I based a large part of my analyses concerning Aim II on existing data sets and a posteriori investigations. I reduced the impact of this limitation by (a) testing the replicability of findings and by (b) conducting an investigation in which I assessed the moderating effect of openness on an a priori basis. I also based my interpretation of the interaction effect on (c) previous high-quality research and theory in the areas of personality, everyday problem-solving, and mental health, and (d) I provided

corroboratory evidence for the interaction effect that was based on these post hoc assumptions. I further presented (e) a full list of measures and manipulations in Appendices A, B, D, and E for data sets that contained variables relating the original Aim II in order to be transparent about which measures were employed in each study. I also (f) summarised the results of the main computations relating to the original Aim II in Appendix C. Therefore, although post hoc examinations and assumptions are less desirable than theory-driven hypotheses-testing (e.g., John, Loewenstein, & Prelec, 2012; Kerr, 1998), I addressed many of the suggestions for improvement that have been identified for the use of a posteriori practices.

Neuroticism as DV. As mentioned in Chapters 1 and 3, I employed the personality variable of neuroticism as the main dependent measure of negative emotionality across my investigations. Although this choice was largely due to the post hoc nature of my second research aim, the use of neuroticism as a dependent measure has been employed previously in a variety of studies (e.g., Beech, 2001; Engeli et al., 2014; Farmer et al., 2002; Goodwin & Hamilton, 2002; Zanon & Hutz, 2013). It has also been found that neuroticism detected changes in negative emotionality (Beech, 2001; Enns et al., 2006; Farmer et al., 2002). I employed alternative measures of negative emotions as dependent variables to test whether the moderating effect of openness would predict more state-based measures of negative emotions. Interestingly, the predictability of the moderating effect of openness was reduced for those alternative measures, indicating that the trait-based measure of neuroticism was more sensitive measure to detect variabilities in negative emotions among independent and interdependent problem-solvers. It is possible that only differences in the accumulated long-term negative effects could be detected, but not the relatively weak short-term negative emotional effects.

Self-report measures. A further important limitation relates to the validity of the IIPSS and the measures employed in the current thesis. The current thesis only employed self-report data that may not have accurately reflected actual behaviour. Chan (2009) pointed out that recall errors can occur on variables that assess the “frequency of information seeking or performing some typical behaviours” (pp. 309–310). The IIPSS falls under this description because it measures people’s preference for independent versus interdependent problem-solving behaviour. Participants may have made erroneous responses because they recalled some behaviour more readily than others. This could have also occurred when I asked participants to recall their help-seeking behaviours in the previous week in order to establish the criterion-related validity of the IIPSS. Therefore, the predictive validity of the IIPSS has not been established conclusively in the present thesis. It is also a general limitation of the present thesis that no objective measures have been employed.

Causal Order of Variables. Due to the cross-sectional design of the current research, the causal order of the relation between openness, problem-solving style, and neuroticism could not be established in the present research. For example, as I discussed in an earlier section of the General Discussion, it is possible that problem-solving style moderates the relation between openness and neuroticism. This is a limitation of the current research because this causal ambiguity impacts the interpretability of the effect. This would be especially true if neuroticism was one of the independent variables.

Future Research Directions

Overall, the present thesis and previous investigations employing the IIPSS (Rubin et al., 2012; Vieira, 2013) demonstrated that the scale facilitates novel insights into the differential effects of independence versus interdependence in everyday

problem-solving situations. However, further comparisons with other relevant measures of independence and interdependence would give a more comprehensive account of the validity of the IIPSS. It would be particularly relevant to assess the convergent validities with other related measures such as Strough et al.'s (2002) measure of everyday problem-solving preferences and the Relational, Individual, and Collective Coping Scale (Hardie et al., 2006). To further establish the scale's validity, it is also important to establish in controlled laboratory settings whether differences in problem-solving styles are due to person-based characteristics alone, as proposed by Rubin et al. (2012), or whether those differences are potentially influenced by situational facilitators and constraints. Situational factors could enable or restrict help-seeking and therefore account for a proportion of the differences observed in regards to problem-solving style. Future studies should assess individuals' problem-solving styles under laboratory conditions and control for situational influences.

The current study suggested that independent and interdependent problem-solving was not confounded with desires to avoid problems. Non-significant correlations with measures of problem-avoidance indicated that both independent and interdependent problem-solvers were motivated to solve their problems. Future research could work to establish a more nuanced assessment of problem-solving style and problem-solving avoidance. Similar to tendencies for social loafing (e.g., Latané, Williams, & Harkins, 1979), it is possible that some interdependent problem-solvers try to reduce their personal workload by delegating tasks to other people. In that way, rather than trying to ignore the problem per se, some interdependent problem-solvers may be trying to avoid the work that is involved in solving the problem by delegating tasks to other people. This more fine-grained approach to problem-solving avoidance could be addressed in future research.

The interactive effect of openness and problem-solving style on negative emotionality bears several directions for further investigations. Importantly, future research should conduct a longitudinal assessment of the interaction effect because a longitudinal design would clarify the causal relations between variables. Future research should also investigate the development of problem-solving styles and examine why some individuals engage in a problem-solving style that constitutes a mismatch with their problem-solving appraisals. It is possible that various intrapersonal characteristics and environmental factors influence problem-solving preferences. As I discussed earlier in this chapter, age differences could also account for some of the variability in problem-solving preferences. The trend for increases in independent problem-solving with older age could be due to possible increases in social isolation (see Wenger, Davies, Shahtahmasebi, & Scott, 1996) or due to possible increases in perceived personal problem-solving expertise in various domains (Artisticco, Cervone, & Pezzuti, 2003; Blanchard-Fields, 2007; Thornton & Dumbke, 2005). These possibilities should be addressed in subsequent investigations.

Testing the generalizability of the moderating effect of openness across different samples would further inform the scope of the effect. In particular, future research should test the replicability of the moderating effect of openness in clinical samples. The moderating effect of openness was less pronounced in a sample comprised of academic researchers ($p = .097$), suggesting that the generalizability of the moderating effect of openness found in student samples was reduced among academics. However, in the area of social problem-solving, functional problem-solving approaches moderated the relation between everyday stressors and negative affectivity in student samples and in clinically depressed samples (for an overview, see Nezu et al., 2004). These results demonstrated that differences in social problem-solving generalized to clinical samples.

It would be interesting to note whether the interactive effect of openness and problem-solving style on neuroticism is more or less pronounced in samples with clinically high levels of neuroticism. Deary, Peter, Austin, and Gibson (1998) found that individuals who were diagnosed with personality disorders differed from healthy individuals in terms of the severity of their neurotic trait expression. Hence, Deary et al.'s findings indicated that the difference between clinical and non-clinical samples were quantitative in nature rather than qualitative. Therefore, the moderating effect of openness may also apply to individuals who experience abnormally high levels of negative emotionality.

Also related to the generalisability of the moderating effect of openness, it would be interesting to note whether the interaction effect is replicable in cross-cultural samples. The conceptualisation of independence and interdependence in problem-solving situations is based on relational-interdependent self-construal in Western countries (Cross et al., 2000; Rubin, 2011c). Kitayama, Karasawa, Curhan, Ryff, and Markus (2010) investigated how cultural differences in independence and interdependence influenced sources of wellbeing in American and Japanese samples. Kitayama et al. found that the independent cultural value of personal control was related to greater wellbeing only among American participants, while the interdependent cultural value of relational harmony was related to greater wellbeing only among Japanese participants. The authors concluded that variations in Eastern and Western cultural scripts accounted for these unique pathways to wellbeing. The present findings suggested that independent problem-solvers who had high levels of openness, self-efficacy, and an innovative style showed lower levels of negative emotions than interdependent problem-solvers. This result could be specific to Western cultures that value individualism (see Kitayama et al., 2010). The student samples of the present research were derived in Australia, which is a colonial Western country (e.g., Hofstede,

1980). The international sample employed in Study 3 was also mostly derived from Western countries. Future research should investigate the conditional effect of problem-solving style on negative emotionality in Eastern countries such as Japan to assess whether the findings of the present research show variability in samples that are influenced by Eastern value systems.

Openness is the most multi-faceted trait of the Big Five and it is also the trait that researchers consider the most ambiguous because it includes facets of intellect, originality, and culture (see, for example, John & Srivastava, 1999). In the current thesis, I assumed that the moderating effect of openness reflects an inherent positive appraisal of one's own cognitive and behavioural problem-solving abilities. The BFI items describe openness to experience largely in terms of originality and open-mindedness. As I have demonstrated in Study 4, the moderating effect of openness only occurred with the openness facet that described imagination, but not with the openness facet that was related to the appreciation of artistic experiences. Thus, it would be interesting to note in further research whether the moderating effect of openness prevails with Big Five measures that lay greater emphasis on the cultural aspects of the trait (e.g., Norman, 1963) or on the intellectual aspects of the trait (e.g., Goldberg, 1990; Saucier & Goldberg, 1996).

As mentioned in the case of workaholism in Chapter 1 (Bonebright et al., 2000; Burke, 1999; Seybold & Salomone, 1994; Spence & Robbin, 1992), extreme cases of independent problem-solving may be of concern even if those individuals feel that they have the capacity to solve problems on their own. To prevent burn-out and other negative mental health consequences in highly capable employees, it may be advisable that working environments encourage shared task completion processes as a complementary strategy to high self-reliance in the work place. This may also benefit

employees who prefer to solve their tasks on an interrelated basis, and thus potentially protect a wide array of employees from negative mental health consequences in challenging working environments. Thus, future research should investigate whether extreme cases of high independence can have negative consequences for mental health, and whether the negative consequences of problematic problem-solving patterns can be alleviated by more interdependent approaches to solving problems in the workplace.

Implications of the Research Findings

The Usefulness of the IIPSS

The IIPSS is a unique measure that captures a stable general preference for independent or interdependent problem solving. Expanding on previous findings (Rubin et al., 2012; Vieira, 2013), the current research gave further indication that the IIPSS reliably measures this preference. In the present research, assessments of the psychometric properties of Version 2 of the IIPSS revealed that the measure had a unidimensional structure, good internal consistency, good test-retest reliability, and predicted convergent and divergent validities with relevant measures. The IIPSS has also been shown to reveal effects of everyday problem-solving styles in the areas of mental health, social integration, and consumer behaviour (Rubin et al., 2012; Vieira, 2013). Hence, the current research presented additional evidence that the IIPSS is a suitable measure to assess differences in independence and interdependence in problem-solving situations.

Furthermore, the present findings suggested that there are weak gender and social class differences in problems-solving styles, but that independent problem-solving slightly increases with age. This indicates that older populations may become more prone to negative emotional effects if older-aged people tend to be low in openness and self-efficacy appraisals. Therefore, older adults who are prone to

independence and low openness or self-efficacy appraisals may be more at risk of developing negative emotional outcomes than men and lower social class individuals in general. Research endeavours of the interactive effect of problem-solving style and openness on negative affectivity in older adults thus may be particularly useful.

Theoretical Implications of the Moderating effect of Openness

The findings of the current research extended on Hardie et al.'s (2006) observations on self-coping complexity. Hardie et al. did not find any differences between independent and relational coping clusters on negative affect. However, the present research found that independence and interdependence have differential effects on mental health when more complex relations were taken into account. In particular, the current research suggested that different levels of openness and personal problem-solving appraisals indicated when independent or interdependent problem-solving predicted greater levels of negative emotionality. Interestingly, negative emotional effects were particularly pronounced among people who were independent problem-solvers and low in openness. The relations between openness, problem-solving style, and neuroticism were mediated by state-based levels of stress and anxiety in Study 4, indicating that the conditional effect of openness and problem-solving style on trait-based levels of negative affect could be explained by recent feelings of negative affect. These findings were in line with Heppner et al.'s (2004) recommendations concerning the usefulness of observing complex relations between personal problem-solving and psychological adjustment in that the current study revealed novel relations in regards to problem-solving styles, problem-solving self-appraisals, and negative emotions. The current research also suggests that, although openness has been shown to have specific stress-alleviating effects in general (e.g., DeYoung, 2014; Oswald et al., 2006; Schneider et al., 2012; Spink et al., 2014; Williams et al., 2009), these effects are

particularly pronounced in independent problem-solvers compared to interdependent problem-solvers.

Applied Implications of the Moderating Effect of Openness

With regards to intervention programs in the area of social problem-solving (see Bell & D’Zurilla, 2009; D’Zurilla, 1988; D’Zurilla & Goldfried, 1971; Heppner & Hillerbrand, 1991), the present findings relating to Aim II could have a number of clinical applications. For example, it would be beneficial for clinicians to note whether clients’ problem-solving styles match their levels of openness and problem-solving self-efficacy appraisals. Targeted suggestions that guide clients to engage in matching problem-solving approaches may help alleviate the impact of distress in everyday problem-solving situations, and thus aid in establishing beneficial long-term emotional consequences. Counsellors may also benefit from the information that a combination of a low level of openness and an independent problem-solving style in addressing everyday tasks particularly impact on negative emotional patterns. Older adults might be more likely to be both independent and low in openness because independent problem-solving and low levels of openness are more pronounced in old age (McCrae & Terracciano, 2005; Donnellan & Lucas, 2008; Strough et al., 2002). However, this particular clientele may face exceptional challenges in therapeutical settings. For example, the current research indicated that independent problem-solving is positively related to help-seeking threat and help-seeking avoidance, as well as a substantially lower likelihood of seeking help in case of a severe personal (i.e., suicidal) crisis as compared to interdependent problem-solvers ($r = -.44$). Therefore, independent problem-solvers who would benefit from clinical interventions may show a particularly strong resistance to enter treatment. It has also been noted that individuals in counselling professions typically score high in openness to experience and favour

openness to closed-mindedness (McCrae & Sutin, 2009; Staudinger, Maciel, Smith, & Baltes, 1998). Therefore, it may be challenging to form a secure client-counsellor relationship that facilitates therapeutic success. Further complicating the therapeutic process, individuals low in openness have been shown to terminate therapeutic interventions prematurely (Butcher, Rouse, & Perry, 1998; Hatchett, Han, & Cooker, 2002), thereby reducing the likelihood of lasting positive treatment outcomes. The current research supports the notion that individuals who are low in openness to experience show improved mental health effects if other people participate in their everyday problem-solving endeavours. Therefore, strengthening and encouraging clients' ability to include other people in their problem-solving processes may be a more convenient way to improve psychological adjustment long-term if closed-minded clients show resistance in accepting cognitive changes in relation to their levels of openness and self-efficacy appraisals.

Closing Remarks

I am concluding this chapter by addressing my own experience with independent and interdependent problem-solving approaches. The present thesis examined independent and interdependent problem-solving from an interindividual perspective. From my own experience, I assume that preferences for independent and interdependent problem-solving also show intraindividual variability. I can say that I used to solve university-related problems mostly on my own because I felt that I was more efficient when I worked on tasks self-sufficiently. I would only ask for advice when I was unclear about what I had to do, or when I required additional information on how to organize my coursework. When I started working on my dissertation thesis, I was under greater supervision than before. Because of regular meetings with my supervisor, my approach to solving academic problems changed. I had the opportunity to hand in

mediocre drafts, and discuss what needed to be improved at early stages of the thesis writing process. Therefore, I transitioned to a more interdependent way of approaching my research endeavours. I experienced first-hand how situational influences, in addition to personal characteristics, can shape problem-solving orientations. Generally, a more nuanced approach to investigating independence and interdependence is needed to shed further light into the development of problem-solving styles and their differential effects in everyday living.

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Appendix A: Full List of Measures in Study 1

Listed below is the full list of measures used in the first study called “Starting University.” Measures relevant to the current research rationale are presented in Chapter 3.

Table A.1

Full list of measures presented to participants in Study 1

Measure	Author(s) and year	Number of items	Example item
Independent-Interdependent Problem-Solving Scale	Rubin, Watt, and Ramelli (2012)	10	“I do not like to depend on other people to help me to solve my problems.”
Big Five Inventory	John and Srivastava (1999)	44	“I see myself as someone who has an assertive personality”
Perceived Task Difficulty	Self-generated	4	“When I first started university, I already knew about some of the subjects raised in my seminars”
Subjective perceptions of students’ academic performance	Self-generated	10	“I have been attentive during the lectures”
University feedback to date	Self-generated	1	“If you have received any feedback from university, how positive has that feedback been?”
Australian Tertiary Admission Rank performance	Self-generated	1	“What was your ATAR (Australian Tertiary Admission Rank) without bonus points?”
Open Foundation performance	Self-generated	1	“If you don’t have an ATAR score, what was your average mark across all Open Foundation courses?”
Self-perceived quality of friendships	Rubin and Wright (under review)	3	I feel close to my friends at the university.

Table A.1 Continued

Measure	Author(s) and year	Number of items	Example item
Modified Friendship Scale*	Hawthorne (2006)	6	During my time at the university, It has been easy to relate to others.
Modified community participation subscale of the Perceived Community Support Questionnaire*	Herrero and Garcia (2007)	5	“I take part in social activities at the university”
Modified Sense of Belonging scale*	Hurtado and Carter (1997)	6	“I feel that I am a member of the university community”
Guidance subscale of the Social Provisions Scale	Cutrona and Russell, (1987)	4	“There is a trustworthy person I could turn to for advice if I were having problems”
Availability of informational support	Self-generated	9	“If I need to ask for help, I know how to get help from my lecturer”
Quality of available help	Self-generated	9	“When I receive help from other people, I usually feel well informed.”
Perceived Awareness of the Research Hypothesis	Rubin, Paolini, and Crisp (2010)	4	“I knew what the researchers were investigating in this research”
Self-Reported Single-Item Indicator	Based on Maede and Craig (2012)	1	“Did you answer truthfully to all of the given questions in this survey?”
Subjective class-identity measure	Ostrove and Long (2007)	1	“My social class is...”
Education level of parents as proxy for social class	Modified from the New South Wales Population Health Survey (2009)*	2	“Please indicate the highest education level achieved by your mother”

Note. *Modifications of the measures had the purpose of adjusting the wording to the university or student context

Appendix B: Full List of Measures in Study 2

Listed below is the full list of measures used in the second study called “Working Styles.” Measures relevant to the current research rationale are presented in Chapter 4.

Table B.1

Full list of measures presented to participants in Study 2

Measure and Procedures	Author(s) and year	Number of items	Example item
Independent-Interdependent Problem-Solving Scale	Rubin, Watt, and Ramelli (2012)	10	“I do not like to depend on other people to help me to solve my problems.”
Big Five Inventory	John and Srivastava (1999)	44	“I see myself as someone who has an assertive personality”
Impression Management subscale of the Balanced Inventory of Desirable Responding scale (Version 6, Form 40)	Paulhus (1991)	20	“I never swear”
Perceived Awareness of the Research Hypothesis	Rubin, Paolini, and Crisp (2010)	4	“I knew what the researchers were investigating in this research”
Self-Reported Single-Item Indicator	Based on Maede and Craig (2012)	1	“Did you answer truthfully to all of the given questions in this survey?”
Modified Alternate Uses Test	Christensen, Guilford, Merrifield, and Wilson (1960)	8	“Please type in as many uses as you can think of for: Paper Clip”
Modified Prediction of Task Duration	Adapted from Kelly, Johnson, and Miller (2003)	10	“Below, please give your estimate of how long you think it would take to read the previous passage”

Note. *Modifications of the measures had the purpose of adjusting the tasks to the study design (e.g., participants could choose to see responses from previous participants for each task). The number of items was also modified (e.g., only 8 out of a total of 20 uses from the Alternate Uses Test were presented to participants).

Experimental Manipulation

After completion of the IIPSS and BFI measures, participants were presented with priming photographs that have been successfully used in previous research to prime the concept of either prosocial affiliation or nonaffiliation (Rubin, 2011b). Because the priming conditions did not yield any statistically significant results in Study 2, I collapsed the two conditions.

Appendix C: Summary of Main Computations to Test the Original Aim II

Listed below is a tabular representation of the interaction analyses that I conducted in Studies 1 – 4 in relation to my initial Aim II. The proposed moderating effect of problem-solving style on the relation between Big Five personality traits and associated behavioural and psychological outcome variables were not significant or replicable in my investigations. Consequently, I changed my second research to the conditional effect of problem-solving style on negative emotionality, which yielded meaningful results. I used Model 1 of Hayes' (2013) PROCESS software to compute the regression analyses.

Table C.1

Regression analyses testing the moderating effect of problem-solving style on the relation between personality and associated behavioural and psychological variables.

Study No.	M	IV	DV	M x IV			
				<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>
1	IIPSS	Conscientiousness	Cumulative Weighted Average Mark (Semester 1)	-.34	.61	-.55	.580
1	IIPSS	Conscientiousness	Cumulative Grades Point Average (Semester 1)	-.01	.07	-.19	.852
1	IIPSS	Agreeableness	Social Integration	.02	.05	.37	.710
1	IIPSS	Agreeableness	Perceived Quality of Friendships	.08	.06	1.17	.242
2	IIPSS	Openness	Creativity Score	.17	.25	.66	.510
3	IIPSS	Conscientiousness	<i>h</i> Index	2.09	1.19	1.76	.082

Table C.1 Continued

Study No.	M	IV	DV	M x IV			
				<i>b</i>	<i>SE</i>	<i>t</i>	<i>p</i>
3	IIPSS	Conscientiousness	<i>eigenfactor</i> Journal Ranking (Single-authored Paper)	3.64	2.56	1.42	.159
3	IIPSS	Conscientiousness	<i>eigenfactor</i> Journal Ranking (Multi-authored Paper)	2.76	2.29	1.21	.230
4	IIPSS	Neuroticism	Satisfaction with Life	-.07	.04	-1.52	.130
4	IIPSS	Agreeableness	Social Integration	.01	.04	.22	.823

Note. M = Mediator, IV = Independent Variable, DV = Dependent Variable, M x IV = Joint effect of the moderator and independent variables

Appendix D: Full List of Measures in Study 3

Listed below is the full list of measures used in the second study called “Academic Working Styles and Performance.” Measures relevant to the current research rationale are presented in Chapter 5.

Table D.1

Full list of measures presented to participants in Study 3

Measure and Procedures	Author(s) and year	Number of items	Example item
Independent-Interdependent Problem-Solving Scale	Rubin, Watt, and Ramelli (2012)	10	“I do not like to depend on other people to help me to solve my problems.”
Big Five Inventory	John and Srivastava (1999)	44	“I see myself as someone who has an assertive personality”
Single Author Ratio	Self-generated	1	Approximately, what percentage of your overall papers are you the first author?
Subjective Performance Self	Self-generated	1	“How would you rate your own research performance?”
Subjective Performance Supervisor	Self-generated	1	“How would your immediate supervisor rate your research performance?”
Overall Paper Number Self-generated	Self-generated	1	“Approximately, how many publications have you published overall in your academic career?”
University Ranking	Self-generated	1	“Approximately, what is the current national ranking of the university at which you work?”
Grant Money	Self-generated	1	“Approximately, how much grant funding did you receive in the last five years?”

Table D.1 Continued

Measure	Author(s) and year	Number of items	Example item
Academic Position	Self-generated	1	“What is the status of your academic rank?”
Age PhD	Self-generated	1	“In which year were you awarded your PhD?”
Conference Attendance	Self-generated	1	“Approximately, how many professional conferences did you attend in the last five years?”
Current Projects Collaboration	Self-generated	1	“Approximately, how many people do you currently collaborate with on research projects?”
Guidance subscale of the Social Provisions Scale	Cutrona and Russell, (1987)	4	“There is a trustworthy person I could turn to for advice if I were having problems”
Quality of available help	Self-generated	9	“When I receive help from other people, I usually feel well informed.”
Collaboration Style	Self-generated	5	“Please indicate to what extent you engage in e-mail correspondence.”

In addition to the questions presented in Table D.1, participants were also asked to indicate their *h* index, and their *eigenfactor* and *article influence* scores of their latest single-authored and multi-authored paper. The *h* index is a measure of the quantity and quality of a researcher’s publication output. For example, an *h* index of 5 means that a researcher has published five papers that each have at least five citations. An *eigenfactor* is a measure of the journal’s total importance to the scientific community during the last five years. With all else equal, a journal’s *eigenfactor* score doubles when the journal doubles in size. A journal’s *article influence* score is a measure of the

average influence of each of its articles over the first five years after publication. It is comparable to Thomson Scientific's widely-used *impact factor*.

Appendix E: Full List of Measures in Study 4

Listed below is the full list of measures used in the first study called “Personality and Handling Situations.” Measures relevant to the current research rationale are presented in Chapter 6.

Table E.1

Full list of measures presented to participants in Study 4

Measure	Author(s) and year	Number of items	Example item
Independent-Interdependent Problem-Solving Scale	Rubin, Watt, and Ramelli (2012)	10	“I do not like to depend on other people to help me to solve my problems.”
Short version of the Big Five Inventory	Rammstedt and John (1999)	10	“I see myself as someone who gets nervous easily.”
Extraversion scale	Goldberg et al. (2006)	10	“Know how to captivate people.”
Relational-Interdependent Self-Constraint scale	Cross, Bacon, and Morris (2000)	11	“My close relationships are an important reflection of who I am.”
Short version of the Depression Anxiety and Stress Scale	Lovibond and Lovibond (1995)	21	“I felt scared without any good reason.”
Decision-Making Collaboration Scale	Anderson, Martin, and Infante (1998)	13	“I enjoy participating in decision making.”
General Help-Seeking Questionnaire	Wilson, Deane, Ciarrochi, and Rickwood (2005)	18	“How likely is it that you would seek help from a parent.”
Social Provisions Scale	Cutrona and Russell (1987)	24	“There are people I can depend on to help me if I really need it.”
Multidimensional Scale of Perceived Social Support	Zimet, Dahlem, Zimet and Farley (1988)	12	“There is a special person who is around when I am in need.”

Table E.1 Continued

Measure	Author(s) and year	Number of items	Example item
Ways of Coping (Revised)	Folkman and Lazarus (1985)	66	“I asked a relative or friend I respected for advice.”
Modified Assessment of Achievement Related and Help Seeking Tendencies*	Karabenick and Knapp (1991)	18	“Select helpful lecturers.”
Help-seeking Scales	Karabenick (2003)	13	“If I were having trouble understanding the material in this class I would ask someone who could help me understand the general ideas.”
Single-Item Self-Esteem Scale	Robins, Hendin, and Trzesniewski, (2001)	1	“I have high self-esteem.”
Short Form of the Need for Cognition Scale	Cacioppo, Petty, and Feng Kao (1984)	18	“I prefer my life to be filled with puzzles that I must solve.”
Satisfaction with Life Scale	Diener, Emmons, Larsen, and Griffin (1985)	5	“I am satisfied with life.”
Problem-solving behaviour	Self-generated	6	“Asked a tutor or lecturer.”
Quality of available help	Self-generated	9	“When I receive help from other people, I usually feel well informed.”
Impression Management subscale of the Balanced Inventory of Desirable Responding scale (Version 6, Form 40)	Paulhus (1991)	20	“I never swear”
Perceived Awareness of the Research Hypothesis	Rubin, Paolini, and Crisp (2010)	4	“I knew what the researchers were investigating in this research”
Self-Reported Single-Item Indicator	Based on Maede and Craig (2012)	1	“Did you answer truthfully to all of the given questions in this survey?”

Table E.1 Continued

Measure	Author(s) and year	Number of items	Example item
Paying Attention Single-item Indicator	Based on Maede and Craig (2012)	1	“This item is checking that you are paying attention. To confirm, please respond to this item with strongly agree.”
Subjective class-identity measure	Ostrove and Long (2007)	3	“My father’s social class is...”
Parents’ education level and occupation as proxy for social class	Modified from the New South Wales Population Health Survey (2009)*	4	“Please indicate the highest education level achieved by your mother”

Note. *Modifications of the measures had the purpose of adjusting the wording to the university or student context

Appendix F: Full List of Self-Generated Items in Study 5

Listed below is the full list of items for the self-generated measures used in the fifth study called “Would You Decide to Participate in this Study?” The measures assessed anxiety about solving problems and aspects of problem-solving efficacy and competence available from oneself and others.

Table F.1

Full list of self-generated items presented to participants in Study 5

Measure	Items
Anxiety about solving problems	<p>“If I’m making a decision that really matters, I usually get quite tense.”</p> <p>“Making important decisions in my life usually makes me feel very anxious.”</p> <p>“I stay calm when I need to find a solution to a problem.” (R)</p> <p>“No matter how easy or difficult a problem is, I can keep a clear head.” (R)</p>
Perceived quantity and quality of solutions available from self	<p>“I can come up with plenty of useful solutions to a problem.”</p> <p>“I can think of many good ideas before making a decision.”</p> <p>“I often can’t think of many high quality solutions to problems.” (R)</p> <p>“It takes me a long time to come up with more than one solution to a problem.” (R)</p>
Perceived competence and efficacy of self versus others	<p>“I think I’m better at sorting out problems than other people are.”</p> <p>“I am more skilled at problem-solving than a lot of other people that I know.”</p>

Table F.1 Continued

Measure	Items
Perceived risk of self's solution being wrong	"Other people are better at finding solutions to problems than I am." (R)
	"I know people who are better than me at finding solutions to problems." (R)
	"I often feel that my solutions to problems may be wrong."
	"There's a good chance that I will make the wrong decision about something."
Perceived risk of others' solutions being wrong	"My decisions are usually right." (R)
	"Most of the time, I think that I solve problems the right way." (R)
	"I often feel that other people's solutions to problems may be wrong."
	"There's a good chance that other people will make the wrong decision about something."
	"Most of the time, people that I know solve problems the right way." (R)
	"The decisions of my family and friends are usually right." (R)

Note. Reverse coded items are indicated by (R)