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The Effect of Priming Metacognition and Critical Thinking on Dispelling Psychological Misconceptions

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ABSTRACT

THE EFFECT OF PRIMING METACOGNITION AND CRITICAL THINKING ON DISPELLING PSYCHOLOGICAL MISCONCEPTIONS

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Northern Illinois University, 2021
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This thesis examined to what extent the supraliminal, semantic priming of undergraduate introductory psychology students' metacognitive and critical thinking skills predicts their ability to dispel common psychological myths and misconceptions. This thesis also investigated to what extent undergraduate introductory psychology students' personality traits predict their ability to dispel common psychological myths and misconceptions. Fitting standard and hierarchical regression models, this study found that, although gender, age, year in school, and college-generation status were not significant covariates, persons of color typically exemplified greater endorsement of psychological misconceptions than their White / Caucasian peers. Also, compassion (an aspect of the agreeableness trait on the Big Five), orderliness (an aspect of conscientiousness), and intellect (an aspect of openness / intellect) significantly predicted endorsement of psychological misconceptions: as compassion decreased, orderliness increased, or intellect decreased, endorsement of psychological misconceptions increased. Controlling for these demographic and personality covariates, however, the prime condition was not a significant predictor of endorsement of psychological misconceptions. Those who received metacognitive- and critical-thinking-based words did not demonstrate a different level of endorsement of psychological misconceptions than those who received neutral words. Despite this, 48.05% of

the variation in the endorsement of psychological misconceptions was explained by this complete set of predictors. In terms of the potentially-metacognitively-advanced response of selecting “don’t know” on the misconceptions test, as students’ year level of college when they took an introductory psychology course increased, their frequency of endorsement of the “don’t know” response similarly increased. Also, as orderliness decreased, endorsement of the “don’t know” response increased. Again, controlling for demographic and personality covariates, the prime condition did not significantly predict endorsement of the “don’t know” response on the psychological misconceptions test. Nevertheless, it is evident that a majority of undergraduate introductory psychology students still endorse and believe in many common psychological myths and misconceptions.

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THE EFFECT OF PRIMING METACOGNITION AND CRITICAL THINKING
ON DISPELLING PSYCHOLOGICAL MISCONCEPTIONS

BY

MARISSA RENEE BAMBERGER
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CHAPTER 1

INTRODUCTION

A majority of undergraduate students believe in and endorse several common psychological myths and misconceptions, such as the First Instinct Fallacy. This prevalent myth advises that it is generally best to maintain one's original answer when completing a multiple-choice test. Years of research and scientific evidence, however, has thoroughly questioned the validity and utility of this supposed test-taking strategy, which finds that the majority of answer changes actually switch from being incorrect to correct (Kruger et al., 2005).

Most students enter an introductory psychology course with a variety of myths and misconceptions, and at the end of the course, these false beliefs continue to be endorsed by students, many of which will only ever take one introductory-level psychology course (Cavazos et al., 2021; Taylor & Kowalski, 2004). There are dangers involved with students maintaining their psychological misconceptions as they leave students virtually helpless, inundated by a mystifying mixture of accurate and inaccurate information, disseminated by the popular psychology industry's self-help books, websites, and entertainment media. This hinders students' accurate knowledge acquisition and ability to make educated decisions in their everyday lives (Lilienfeld et al., 2010a). Correcting students' psychological misconceptions, such as their endorsement and belief in paranormal and pseudoscientific beliefs, by teaching individuals to think critically increases students' retention of correct information and is crucial to our society's

health and stability (Lilienfeld et al., 2010a; Wilson, 2018).

Psychological Misconceptions

Psychological misconceptions are defined as commonsense, yet false beliefs about psychological phenomena, such as the mind and behavior, that seem to be familiar and intuitively true but inconsistent with psychological research and tend to be acquired from the informal sources of information present in one's culture (Bensley & Lilienfeld, 2015; Bensley & Lilienfeld, 2017; Bensley et al., 2015). Sources of psychological myths include word-of-mouth, want for easy answers and quick fixes, selective perception and memory, inferring causation from correlation, flawed reasoning, experience with a biased sample, misleading film and media portrayals, exaggeration of a small piece of truth, and confusion with correct terminology (Lilienfeld et al., 2010b). Some students enter the field of psychology with certain misconceptions about the mind and behavior because they think of themselves as "naïve psychologists." This is likely because people have a tendency to want to explain behaviors in terms of psychological phenomena, such as mental states and intentions, even though they do not have the knowledge to do so. Hence, many students do not have coherent, naïve theories but rather pieces of incorrect information gathered from informal, non-scientific sources (Bensley & Lilienfeld, 2015).

Additionally, the belief in and endorsement of psychological misconceptions are often due to individuals' failure or inability to critically think about the presented information that may or may not be accurate. The ability to evaluate claims requires a variety of skills and dispositions. These include possessing and using reasoning and metacognitive abilities that allow

individuals to recognize when beliefs in particular claims may be false and need correction (Bensley & Lilienfeld, 2017).

Metacognition and Critical Thinking

Metacognition and critical thinking are complimentary mental processes. Metacognition can simply be defined as cognition about cognition, or thinking about thinking. Specifically, metacognition is defined as individuals' perceived knowledge about what they know along with the ability to utilize this knowledge to focus and improve their thinking and learning processes (Halpern, 1998). Critical thinking involves a particular set of skills, dispositions, and metacognition (Bensley & Murtagh, 2012). Critical thinking is defined as the use of cognitive skills and strategies in a reasoned and goal-directed way. During the act of critical thinking, individuals evaluate the outcomes of their thought processes, reasoning, decisions, and problem-solving abilities. Critical thinking is "critical" in the sense that it involves individuals engaging in evaluation and judgment to provide feedback that is both useful and accurate for the purpose of improving their thinking processes (Halpern, 1998). Critical thinking also involves the disposition to use these skills, which is the willingness and tendency to engage in effortful thinking and be open, fair, but skeptical when evaluating claims (Bensley & Murtagh, 2012). When simultaneously engaged, the metacognitive skills that are typically used when one critically thinks include planning, monitoring, and evaluating strategies. Therefore, critical thinking requires that individuals are in charge of their thinking processes while these metacognitive skills allow such control to happen (Ku & Ho, 2010). Ultimately, critical thinking is only likely to take place if the individuals not only have the required critical thinking skills,

but also have the disposition and metacognitive self-regulation to appropriately use their critical thinking skills when necessary (Bensley & Murtagh, 2012).

Priming

Priming is defined as the activation of individuals' mental processes by environmental stimuli and the effect that the temporary activation has on individuals' thought, attitudinal, and behavioral processes (Bargh & Chartrand, 2000, Chapter 10). There are two main strategies in which conceptual priming can be delivered: subliminal and supraliminal priming (Bargh & Chartrand, 2010; Dennis et al., 2013; Randolph-Seng & Nielsen, 2007). Subliminal priming is considered to be below threshold and involves the stimulus being presented so quickly that participants are not consciously aware of the stimulus's existence (Dennis et al., 2013).

Subliminal priming sometimes influences individuals' emotions or behaviors, but not necessarily their thoughts, attitudes, and beliefs (Lilienfeld et al., 2010b), which are pertinent when studying the priming of metacognition and critical thinking and level of belief in misconceptions.

Conversely, supraliminal priming is considered to be above threshold and involves participants being consciously aware of the stimulus but not aware of its intent (Dennis et al., 2013).

Therefore, supraliminal priming more appropriately activates individuals' mental processes when attempting to influence their metacognition and critical thinking and levels of belief in misconceptions. Also, there are several ways in which individuals can be primed. One of these methods is semantic priming, which uses words to activate the semantic networks rooted in our semantic memory and draws upon previous associations and experiences with core concepts, objects, and beliefs (Dennis et al., 2013). Hence, through the use of supraliminal, semantic

priming, this study examined to what extent, if any, does the priming of undergraduate introductory psychology students' metacognitive and critical thinking skills predict their ability to dispel common psychological myths and misconceptions.

Personality

Personality traits are a way to describe individuals' relatively stable patterns of cognition, behavior, and affect. There are several theories and standardized ways in which to study personality (Anglim et al., 2020). One major theory of personality is the five-factor model (i.e., the "Big Five"), which was devised from studies that examined trait-descriptive adjectives from the lexicon (Anglim et al., 2020; DeYoung et al., 2007). The Big Five is the most widely used system to classify personality traits and identifies five broad domains of personality, which include such traits as openness, conscientiousness, extroversion, agreeableness, and neuroticism. Personality traits can also be more particularly categorized by arranging traits into hierarchies based on the intercorrelations between traits (DeYoung et al., 2007). A range of facet-level frameworks have been devised for the Big Five (Anglim et al., 2020). Broad domains, such as extroversion, are situated near the top of the hierarchy and include several related, narrower traits. These related, narrower traits are specific patterns of behavior and experience (i.e., facets), such as talking a lot, which are situated near the bottom of the hierarchy (DeYoung et al., 2020).

Individual differences in personality traits have been found to predict not only one's use of metacognitive and critical thinking skills (Clifford et al., 2004; Halpern, 1998; Kelly & Donaldson, 2016), but also individuals' levels of belief in science-related myths (Swami et al., 2016). Research also indicates that there may be a relationship between individuals' differences

in personality and the effectiveness of the priming manipulation on their subsequent behavior (Sela & Shiv, 2009). Hence, this makes personality an important construct to examine when studying the priming of metacognitive and critical thinking skills to aid students in dispelling common psychological myths and misconceptions.

Emerging Adulthood

Emerging adulthood is the developmental life stage in between adolescence and young adulthood. Typical college students fall into emerging adulthood. Even though there are many studies of college students, they make the suspect assumption that college students represent all human adults, which is not the case as emerging adults have not moved into the stable roles, commitments, and responsibilities that define adulthood. Emerging adulthood lasts from approximately 18 years of age, when most have completed secondary school, to 25 years of age, when most begin to head toward more adult roles. However, the end of emerging adulthood is highly variable, with many individuals not transitioning into established, stable adult roles until they are approximately 30 years of age. Nevertheless, emerging adulthood can be characterized by five specific features: (1) identity explorations; (2) instability in love, work, and place of residence; (3) self-focus; (4) feeling in-between adolescence and adulthood; and (5) possibilities, optimism, and hopes for transforming themselves into individuals (Arnett, 2015).

Emerging Adulthood and Cognitive Development

The heart of emerging adulthood (i.e., the late teens and early twenties) are the

predominant years of educational explorations for most individuals (Arnett, 2015). Many individuals experience peak cognitive performance during the years they attend school, with cognitive functioning increasing rapidly throughout childhood and adolescence and peaking in emerging adulthood, as college students practice thinking and knowledge acquisition at unprecedented rates (Bunge & Leib, 2020). Additionally, emerging adults typically experience personal growth throughout college, as they encounter and engage with new ideas and activities, learn about themselves, and develop a more concrete system of views and beliefs (Arnett, 2015; Clifford et al., 2004). Attending college challenges many beliefs that emerging adults had maintained throughout childhood and adolescence, and emerging adults are open to such change as they are determined to think for themselves and devise their own sets of beliefs, independent of their parents. College students are required to think about and question information, skills most emerging adults do not possess or have little control over prior to college (Arnett, 2015).

Additionally, attending college offers the opportunities and experiences that foster development in terms of increasing emerging adults' openness, a personality disposition necessary for the development of certain cognitive abilities (Arnett, 2015; Clifford et al., 2004). College-attending emerging adults tend to acquire a variety of intellectual skills, such as verbal and quantitative reasoning, oral and written communication skills, and critical thinking (Arnett, 2015). Education hones general cognitive skills, such as reasoning, a facet of critical thinking (Bunge & Leib, 2020). Several studies discuss techniques to foster critical thinking skill development in undergraduate-level classes (Bailey et al., 2019; Bensley et al., 2015; Burke et al., 2014; McCarthy & Frantz, 2016), and as undergraduates complete more psychology courses, their critical thinking skills improve (Standing & Huber, 2003). Also, metacognition increases with age, including throughout emerging adulthood. Hence, college students gradually develop

more metacognitive awareness, a self-awareness of their own biases, over the course of their college careers (Kleka et al., 2019).

Moreover, emerging adults with adequate metacognitive skills have the resources to handle the challenges that face them and improve their metacognition, while other emerging adults can become overwhelmed by the new, complex decision-making responsibilities that are expected of them, falling back to less cognitively-demanding thinking strategies (Kleka et al., 2019). Therefore, if undergraduate emerging adults can be supraliminally primed to use their metacognitive and critical thinking skills, such that they are not aware of the priming stimuli's purpose or possible influence on their subsequent information processing, then those who are typically overwhelmed by cognitively-demanding information processing strategies (e.g., metacognition and critical thinking) may not have the chance to consciously rebel against such an attempt to activate and use these skills. Thus, the examination of whether priming undergraduate students' metacognitive and critical thinking skills facilitates their ability to dispel common psychological myths and misconceptions, in addition to the potential predictive power of their personality traits, may aid in the developmentally-appropriate education of undergraduate introductory psychology students in their emerging adulthood years.

Purpose Statements

The primary purpose of this study was to determine the extent, if any, that the supraliminal, semantic priming of undergraduate introductory psychology students' metacognitive and critical thinking skills predicts their ability to dispel common psychological myths and misconceptions.

The secondary purpose of this study was to determine the extent, if any, that undergraduate introductory psychology students' personality traits predict their ability to dispel common psychological myths and misconceptions.

Research Questions

RQ1: To what extent, if any, does the supraliminal, semantic priming of undergraduate introductory psychology students' metacognitive and critical thinking skills predict their ability to dispel common psychological myths and misconceptions?

RQ2: To what extent, if any, do undergraduate introductory psychology students' personality traits predict their ability to dispel common psychological myths and misconceptions?

Hypotheses

Hypothesis 1: Supraliminal, semantic priming of undergraduate introductory psychology students' metacognitive and critical thinking skills will positively predict their ability to dispel common psychological myths and misconceptions.

Hypothesis 2: Undergraduate introductory psychology students' personality traits will predict their ability to dispel common psychological myths and misconceptions.

Key Concepts

Psychological misconceptions: commonsense, yet false, beliefs about psychological phenomena that seem to be familiar and intuitively true but are inconsistent with psychological research and tend to be acquired from informal sources of information (Bensley & Lilienfeld, 2015; Bensley & Lilienfeld, 2017; Bensley et al., 2015).

Metacognition: cognition about cognition, or thinking about thinking; individuals' perceived knowledge about what they know along with their ability to utilize this knowledge to focus and improve their thinking and learning processes (Halpern, 1998).

Critical thinking: the use of cognitive skills and strategies in a reasoned and goal-directed way (Halpern, 1998).

Personality: a way to describe individuals' relatively stable patterns of cognition, behavior, and affect (Anglim et al., 2020).

Emerging adulthood: the developmental life stage that lasts from approximately 18 years of age, when most have completed secondary school (i.e., the end of adolescence), to 25 years of age, when most begin to head toward more adult roles (i.e., the beginning of young adulthood; Arnett, 2015).

Theoretical Frameworks

Priming

Priming is defined as the activation of individuals' mental processes by environmental

stimuli and the effect that the temporary activation has on individuals' thought, attitudinal, and behavioral processes (Bargh & Chartrand, 2000, Chapter 10). Specifically, supraliminal priming is above threshold and involves participants being consciously aware of the stimulus's existence but not aware of its intent (Dennis et al., 2013). Also, priming "nonconsciously" (i.e., outside of conscious awareness) activates cognitive, information-processing functions. Although participants cannot be aware of the priming stimuli's possible influence on their subsequent information processing, this nonconscious activation can be achieved via supraliminal priming (Chartrand & Bargh, 1996). One method in which individuals can be primed is through semantic priming, which uses words to activate the semantic networks rooted in our semantic memory and draws upon previous associations and experiences with core concepts, objects, and beliefs (Dennis et al., 2013).

The theory of priming is relevant to the present study's primary research question, concerning the extent to which priming undergraduate introductory psychology students' metacognitive and critical thinking skills affects their ability to dispel psychological myths and misconceptions. The supraliminal, semantic prime in the form of a modified scrambled sentence task with metacognitive- and critical-thinking-related words should activate particular mental processes, namely students' metacognitive and critical thinking skills. In turn, this temporary affect on students' thought processes should facilitate students' use of their metacognitive and critical thinking skills when they encounter the subsequent psychological myths and misconceptions.

Primacy and Recency Effects

When examining short-term memory, the model of serial recall creates a simple serial-position curve in which there are primacy and recency effects at both ends of this u-shaped curve. When subjects are exposed to a list of words with the intent of performing immediate free recall on this list, subjects tend to recall the first few words presented very well (primacy effect) and the last few words presented very well (recency effect), better than words presented in the middle of the list (Baddeley & Hitch, 1993; Page & Norris, 1998).

The theory of primacy and recency effects is relevant to the present study's primary research question, concerning the extent to which priming undergraduate introductory psychology students' metacognitive and critical thinking skills affects their ability to dispel psychological myths and misconceptions. According to the primacy effect, given that the supraliminal, semantic prime was the first item that students consciously encountered, the prime should have still been in students' working memory when students were subsequently exposed to the psychological myths and misconceptions. Additionally, according to the recency effect, given that the psychological myths and misconceptions were the most recent items that students encountered as they completed that portion of the experimental tasks, these false beliefs would have still been in students' working memory so that the false beliefs could have been actively evaluated and critiqued by the students' primed metacognitive and critical thinking skills.

Significance of Study

Psychological misconceptions are often endorsed by undergraduate students as they enter

and exit their introductory psychology courses due to a lack of applying metacognitive and critical thinking skills to information (Bensley & Lilienfeld, 2017). Although some (e.g., Kowalski & Taylor, 2009; LaCaille, 2015; Lassonde et al., 2017) have tested instructional techniques to facilitate students in dispelling psychological misconceptions (e.g., refutational instruction), these techniques can only be applied to the selected misconceptions that instructors choose to teach with such an instructional model. They do not promote long-term correction of myth endorsement (Lassonde et al., 2017), and they do not offer students a strategy that is readily employed to every piece of information or misinformation (i.e., misconception) that they encounter. Other studies have found that critical thinking instruction decreases endorsement of psychological misconceptions (e.g., Bensley et al., 2015; Burke et al., 2014; McCarthy & Frantz, 2016), but introductory psychology courses are typically taken before this critical thinking instruction occurs and such introductory courses often do not have time for significant critical thinking instruction.

On the other hand, priming students to use their metacognitive and critical thinking skills may encourage students to routinely practice such cognitive strategies when they encounter questionable information not only in their courses but throughout life. Additionally, while some college students have the metacognitive resources to successfully deal with the decision-making challenges that college courses present to them, others lack these resources and are quickly overwhelmed and regress to less cognitively-demanding thinking strategies (Kleka et al., 2019). Hence, for some students, if they were not overtly told to use their metacognitive and critical thinking skills for certain tasks, but rather supraliminally primed to do so, they would not be so overwhelmed as to consciously refuse to use more cognitively-demanding skills. Priming analytic thinking skills leads to less endorsement of conspiracy theories (Swami et al., 2014), but

it was not yet clear if such priming would lead to less endorsement of commonly-endorsed psychological myths and misconceptions. Moreover, some personality traits have been associated with endorsement of conspiracy theories and myths (e.g., Swami et al., 2012, 2014, 2016), metacognition and critical thinking (e.g., Clifford et al., 2004; Kelly & Donaldson, 2016), and priming effects (e.g., Augustine et al., 2013; Sela & Shiv, 2009). However, there had yet to be a comprehensive and nuanced examination of the personality traits associated with the ability to dispel common psychological misconceptions.

CHAPTER 2

LITERATURE REVIEW

Psychological Misconceptions

Psychological misconceptions are commonsense, yet false, beliefs about psychological phenomena that seem to be familiar and intuitively true but are inconsistent with psychological research (Bensley & Lilienfeld, 2015; Bensley & Lilienfeld, 2017; Bensley et al., 2015).

Instructional techniques to aid students in dispelling psychological misconceptions have begun to be studied, typically from refutation-based approaches.

Psychological Misconceptions and Refutation

It is often incorrectly assumed that standard approaches to introductory psychology instruction will facilitate students' critical thinking skills to evaluate the presented correct information in comparison to their previously-endorsed misconceptions, allowing the misconceptions to no longer be endorsed (LaCaille, 2015; Lilienfeld et al., 2010a). Kowalski and Taylor (2009) studied undergraduate introductory psychology students, comparing how much of the students' misconceptions changed in response to the type of instruction that the students received. The refutational instruction emphasized both the psychological misconception and the

correct empirical information on the topic, whereas the standard instruction only emphasized the correct empirical information, ignoring the misconception. Kowalski and Taylor found that students' beliefs in psychological misconceptions decreased more with the refutational lecture and texts in comparison to the standard lecture and texts. Kowalski and Taylor concluded that introductory psychology instructors must explicitly tell students that their preconceived ideas about many psychological concepts are first inaccurate, immediately followed by clear evidence that the new information presented is in fact correct, to convince students to no longer endorse and believe in the misconception.

Furthermore, LaCaille (2015) studied upper-level psychology students who were assigned to create psychology myth-debunking posters consistent with the refutational approach that were then hung in introductory psychology classrooms without any instructor discussion. The posters reduced the introductory psychology students' belief in the targeted misconceptions, but the effect was more notable with the upper-level psychology students who developed the myth-debunking posters. Lassonde et al. (2017) explained that the refutation style used in the LaCaille (2015) posters that relied on presenting the misconception explicitly with its refutation is vital to the knowledge revision process imperative for changing students' beliefs in psychological misconceptions.

Despite its usefulness for short-term knowledge revision, this refutation-style poster instruction does not necessarily facilitate long-term correction of belief in psychological misconceptions. Introductory psychology students created refutation-style posters of psychological misconceptions and presented them to students who were mostly psychology majors. Despite a small sample, students' beliefs in psychological misconceptions significantly decreased, both immediately after exposure to the posters and seven to 10 days later. However,

the detail and accuracy of the students' explanations about their true or false response to the misconceptions significantly decreased after the delay (Lassonde et al., 2017).

Nevertheless, both instructor- and student-facilitated refutational models may be impractical as instructors do not have time to cover every topic riddled with misconceptions in a detailed, refutational lecture or student project. Also, a backfire effect is increasingly risked when the misinformation is repeated during the refutation of that misinformation because it makes the misinformation seem more familiar (Lewandowsky et al., 2012). Similarly, if the myth or misinformation is simpler and easier to understand than the correct information, the myth will be cognitively more attractive (Lewandowsky et al., 2012). Hence, a strategy that encourages undergraduate psychology students to engage with the presented material in more cognitively-demanding ways, such as a priming task that facilitates their use of metacognitive and critical thinking strategies, may help students begin to endorse the correct information while dispelling the myths and misconceptions.

Metacognition and Critical Thinking

Metacognition is the perceived knowledge about what people know that is used to focus and improve thinking and learning processes, and critical thinking is the use of cognitive skills and strategies in a reasoned and goal-directed way (Halpern, 1998). Metacognition and critical thinking have been studied independently in addition to the ways in which these cognitive skills can be fostered among college-attending emerging adults in terms of dispelling their beliefs in misconceptions.

Metacognition and Critical Thinking and Psychological Misconceptions

Standing and Huber (2003) studied undergraduate students who were currently or previously enrolled in a psychology course, with the majority being psychology majors. A 71% psychological myth acceptance rate was found among the students, which Standing and Huber interpreted as the students demonstrating poor critical thinking skills when they encountered psychological speculations. The students also slowly rejected more myths and demonstrated improved critical thinking as they completed more psychology courses. In general, college students gradually develop and use such cognitively-demanding thinking strategies over the course of their college careers (Kleka et al., 2019), but first-generation college students' critical thinking skills tend to be significantly lower than those of continuing-generation college students (Katreovich & Aruguete, 2017).

According to Burke et al. (2014), psychology-focused critical thinking skills are associated with students' ability to use psychological research principles to effectively evaluate the validity of particular claims. Burke et al. compared the critical thinking gains among undergraduate students within either critical-thinking psychology or philosophy courses after students completed the coursework. Burke et al. found that, in contrast to students in the comparison, non-critical-thinking psychology classes, students in both the critical-thinking psychology and philosophy courses demonstrated a significant reduction in their paranormal beliefs, a subset of psychological myths and misconceptions.

Examining students who were psychology majors enrolled in beginning-level, senior-capstone, or graduate-level psychology courses, Bensley and Lilienfeld (2015) found that students are more confident in their answers about psychological misconceptions that are

frequently encountered and endorsed than misconceptions less frequently encountered and endorsed. Therefore, Bensley and Lilienfeld argue that this inappropriate level of confidence and certainty in psychological misconceptions indicates a metacognitive deficit in which students are unaware of their lack of scientifically-correct knowledge. There is a tendency for students to overestimate their knowledge of psychology but underestimate their endorsement of misconceptions (Bensley et al., 2015). Like the above study and with a similar sample of participants, Bensley et al. found that students instructed in critical thinking, with a focus on psychological misconceptions, endorsed and believed in fewer psychological misconceptions. These results may have been found, however, because these students were psychology majors who have taken more psychology courses and such students tend to answer more items correctly on misconception tests than introductory psychology students.

Although psychology critical thinking courses may improve undergraduate students' discipline-specific critical thinking skills, most students take their one and only psychology course, introduction to psychology, before they have the chance to take such critical thinking courses. Introductory psychology students, however, still must be encouraged to use their metacognitive and critical thinking skills to demonstrate a healthy level of skepticism toward psychological speculations. Thus, undergraduate introductory psychology students beginning their programs or courses may benefit from the use of a supraliminal, semantic priming task to facilitate their use of metacognitive and critical thinking skills when encountering psychological myths and misconceptions.

Similar to the non-introductory, psychology critical thinking courses discussed above, McCarthy and Frantz (2016) examined introductory psychology students in a class in which the instructor focused on having students use their critical thinking skills but did not explicitly dispel

or refute any misconceptions. McCarthy and Frantz used a repeated-measures design in which students took a pre-test at the beginning of the course and a post-test at the end of the course. The pre-test results indicated that students believed in and endorsed many psychological myths and misconceptions. In contrast, the post-test results showed that students had dispelled most of the psychological myths and misconceptions at that point.

It may not always be practical or efficient, however, for introductory psychology instructors to teach students critical thinking skills, as instruction that covers beginning psychological concepts still must occur before these critical thinking skills can likely be developed. This may allow some misconceptions, covered at the onset of the course, to be maintained. Additionally, once students were exposed to the psychological misconceptions on the pretest, some of the students recognized these topics when they were covered later in the course (McCarthy & Frantz, 2016). This seemed to have worked as a sort of prime that indicated to students that these topics were especially important.

Priming

Priming is the temporary activation of individuals' mental processes by stimuli and the effect that this has on individuals' thoughts, attitudes, and behaviors (Bargh & Chartrand, 2000, Chapter 10). Priming has been studied in a wide variety of domains, including that of education, myth endorsement, and analytical thinking.

Priming and Education

Dennis et al. (2013) argue that achievement priming may be effective through the activation of individuals' semantic networks that are connected to higher achievement performance. Among undergraduate introductory business students, an individualized supraliminal achievement priming game increased the number, creativity, and relevance of the ideas generated in a subsequent group task, compared to those exposed to a neutral prime. In educational settings, Engeser et al. (2016) argue that students are frequently exposed to semantic stimuli that work similar to semantic primes through their textbooks, instructors, and peers. Among German high school and undergraduate students, they found that the semantic achievement primes embedded into math and language textbooks produced a priming effect on students' performance on subsequent arithmetic and anagram tasks, respectively. Engeser et al. concluded that semantic primes influence students' achievement when these primes are embedded into running text, indicating that the effectiveness of priming is not limited to single words, increasing priming's practical relevance in natural classroom settings. However, the effect sizes found in this study were small, and a reliable effect was only detected due to achieving high statistical power with a large sample size.

Priming, False Beliefs, and Metacognition and Critical Thinking

Examining British undergraduate introductory psychology students, Swami et al. (2014) used a scrambled-sentence verbal fluency task to prime participants, who were randomly assigned to either the analytic or control prime condition and completed a measure of their belief

in conspiracy theories weeks prior to as well as immediately after the priming manipulation. Like psychological myths and misconceptions, conspiracy theories are another subset of false beliefs that many people endorse. Prior to the priming manipulation, Swami et al. found no differences in the participants' conspiracy theory beliefs. After the implicit priming manipulation, participants in the analytic priming condition demonstrated lower belief in conspiracy theories than participants in the control condition. Hence, facilitating participants to use their analytic thinking skills led to less conspiracy theory endorsement in the short term. However, even with a delay in Swami et al.'s study, using a repeated-measures design in which participants were exposed to the conspiracy theories twice may have influenced participants in terms of their responses on the second administration of the conspiracy theories test; the participants may have realized that having been exposed to the priming task means that their responses to the conspiracy theories should now differ from the first administration to the second administration of the test. Nevertheless, promoting students to use their metacognitive and critical thinking skills via a priming task may lead students to dispel and endorse fewer psychological myths and misconceptions more definitively when only exposed to the misconceptions test once, immediately after a metacognitive and critical thinking priming task.

Personality

Personality is a way to describe individuals' relatively stable patterns of cognition, behavior, and affect in terms of their traits (Anglim et al., 2020). Personality is an extensively studied topic that may be predictive of many educationally-relevant abilities and dispositions, including that of myth endorsement, metacognition and critical thinking, and priming.

Personality and Belief in Myths

Students who were more likely to believe in misconceptions typically maintained a more intuitive and less reflective thinking style as they approached information (Bensley et al., 2015). Swami et al. (2014) found that those who maintained a greater belief in conspiracy theories, a subset of false beliefs much like misconceptions, were more likely to maintain a lower analytic and open-minded thinking style but greater intuitive thinking style. Swami et al. (2012) also found that human-related myths, but not non-human-related myths, were significantly associated with and predicted by the personality trait of extroversion.

In contrast to studying broad science-related myths, Swami et al. (2016) used an alternative method and focused on a specific myth, namely the “giant skeleton” myth that began via digitally-altered photographs and a widely disseminated fictitious narrative. Using German adults, Swami et al. found a significant relationship between stronger beliefs in the giant skeleton myth and lower openness to experience but higher neuroticism scores; however, only openness to experience was a significant predictor of belief in the myth. According to Swami et al., this association is likely based on how openness to experience correlates with intelligence and intellectual curiosity. Individuals with improved cognitive abilities may be more intellectually suspicious, especially when they are presented with information that is spread widely but is of unknown accuracy. Consistent with this interpretation, need for cognition is a personality construct related to individual inclination to analyze information and think critically about ideas. Among German undergraduates, Fleischhauer et al. (2010) found a significant, positive relationship between need for cognition and openness to experience. Significant but less substantial relationships were also observed between need for cognition and conscientiousness (a

positive relationship) and neuroticism (a negative relationship). This may also begin to explain why those who completed only the minimum schooling requirement more strongly agreed with the giant skeleton myth than those who completed higher education, although Swami et al. (2016) noted that there was a small effect size to this difference. Hence, it may be developmentally essential for emerging-adult undergraduate students to attend college to foster their development related to the personality traits and cognitive strategies necessary to more readily dispel psychological myths and misconceptions. Considering more nuanced information about undergraduate introductory psychology students' personalities in terms of their ability to dispel a particular group of myths, namely common psychological myths and misconceptions, was an important, yet relatively unexamined, endeavor at this point.

Personality and Metacognition and Critical Thinking

Kelly and Donaldson (2016) found similarities between behaviors associated with both personality and metacognition, such as behavioral variability in organizational and time management skills. In a study of undergraduates examining academic success, Kelly and Donaldson used the NEO-Five Factor Inventory, a revised and shortened version of the NEO-Personality Inventory – Revised (NEO-PI-R; Costa & McCrae, 1992), to measure the Big Five personality traits. A significant, positive relationship was found between metacognition and conscientiousness. The predictive power of metacognition in terms of academic success depended on individuals' personality: when individuals were high in conscientiousness, metacognition predicted academic success, but when individuals were low in conscientiousness, metacognition did not predict academic success. This suggests that only conscientious

individuals will utilize metacognitive strategies and behaviors to achieve academic success.

However, the lack of a relationship between metacognition and the other personality traits could be due to the authors' metacognition tool, which focused on academic behaviors, while extroversion and agreeableness focus on social experiences.

In addition to metacognition and critical-thinking-related skills, a particular set of dispositions is required for individuals to engage in critical thinking (Bensley & Murtagh, 2012). Disposition is much like personality. Individual differences in critical thinking are due to a combination of the individual's cognitive ability and personality dispositions, and the two-factor theory of critical thinking considers both of these components (Clifford et al., 2004; Halpern, 1998). A critical thinker tends to have several particular dispositions or attitudes: (1) a willingness to recognize when critical thinking is required and engage in effortful thinking, (2) a flexibility or an open and fair mind when evaluating claims while remaining skeptical of unsubstantiated claims, (3) a routine use of plans to suppress impulsive thoughts and behaviors, (4) a willingness to discard ineffective strategies when attempting to self-correct, and (5) an awareness of the social realities that need to be achieved, such as a consensus or compromise, for thoughts to become actions. Even if individuals possess the skills to critically think, they may not utilize those skills if they lack the appropriate dispositions (Bensley & Murtagh, 2012; Halpern, 1998).

In a study of undergraduates, Clifford et al. (2004) applied the five-factor model of personality, using the NEO-PI-R (Costa & McCrae, 1992), to the two-factor model of critical thinking. The results indicated that openness to experience significantly predicted individuals' critical thinking beyond their cognitive ability. The contribution that both cognitive abilities and personality dispositions have to individual differences in critical thinking ability has important

implications for college-aged student development. Attending college provides a multitude of opportunities to engage in new activities, with various ideas and a culture of intellectualism that is often lacking in students' home environments. According to Clifford et al., these opportunities and experiences may foster the development of college-aged students by increasing their openness, evident in both their personalities and ways in which they think. Thus, attending college alone may be crucial for emerging adults to experience the personality development beneficial for strong critical thinking skills. However, the college educational experience in particular also needs to facilitate college students' use of their metacognitive and critical thinking skills, potentially via priming, for students to learn accurate information and dispel the common psychological myths and misconceptions in which they believed entering college.

Personality and Priming

In terms of affective (i.e., emotional) primes, Augustine et al. (2013) addressed whether individual personality differences exist by examining the effects of positive and negative affective primes. Individual differences are important when examining the effects of affective priming because affect reactivity, an internal process influenced by individual differences, is a crucial component. Affective personality traits, such as neuroticism and extroversion, can predict the ways in which individuals will react to an affective stimulus used in priming; individuals who are higher in these traits tend to have emotional responses of greater magnitude to the stimuli. Augustine et al. used the Big Five Aspects Scale (BFAS; DeYoung et al., 2007) to assess undergraduates' neuroticism and extroversion as well as a word priming task that had either positive or negative affective words. Person-level factors, such as affect reactivity and

personality, were necessary to reveal the effect of the affective word primes on participants' evaluative judgments. Therefore, person-level effects at least partially determine the influence of affective primes on individuals' subsequent behaviors and decisions.

Additionally, Sela and Shiv (2009) noted a distinction between primes activating personality traits and stereotypes, which is when the behavioral effect of priming dissipates quickly, versus primes activating goals, which is when the behavioral effect of priming persists or increases. Adult participants performed a sentence unscrambling task which served as the priming manipulation and contained target words relating to frugality or luxury. Sela and Shiv found that when situational primes are consistent with individuals' self-concepts, the prime is more likely to influence their behavior via personality activation and have a diminishing effect. However, when situational primes are not consistent with individuals' self-concepts, the primes are more likely to influence behavior via goal activation and have an escalating effect. Thus, there is reason to believe that individual differences, often defined by personality traits, are an important consideration when examining the effects of supraliminal, semantic primes.

Therefore, there have been relationships established between personality traits and broad and specific conspiracy theories and myths, metacognition and critical thinking, and priming. However, a relationship had yet to be clearly established for how personality traits would relate to undergraduate introductory psychology students' ability to dispel common psychological myths and misconceptions. In priming students' metacognitive and critical thinking skills, students' personalities may be a factor to take into consideration. Hence, to understand how to promote students' abilities to dispel psychological misconceptions via priming, it may also be important to understand how individual students' personalities are related to their ability to dispel such misconceptions, above and beyond the influence of the priming manipulation.

CHAPTER 3

METHOD

Study Design

The present study used an experimental design to approach the research questions. Specifically, a between-group, post-test design was used. The primary research question asked to what extent, if any, does the supraliminal, semantic priming of undergraduate introductory psychology students' metacognitive and critical thinking skills predict their ability to dispel common psychological myths and misconceptions. The independent variable was the metacognitive and critical thinking prime. This was in the form of a supraliminal, semantic priming task. The dependent variable was the undergraduate introductory psychology students' ability to dispel common psychological myths and misconceptions, which was measured by their score on a psychological myths and misconceptions test. The secondary research question asked to what extent, if any, do undergraduate introductory psychology students' personality traits predict their ability to dispel common psychological myths and misconceptions. The predictor variables were the personality traits of the undergraduate introductory psychology students, which were measured by their scores on multiple personality subtests. The dependent variable was, again, their ability to dispel common psychological myths and misconceptions, measured by their score on the same misconceptions test.

An experimental design was the best fit for the present study's primary research question for a variety of reasons. Group comparisons using a convenience sample were made by manipulating the independent variable and examining whether it had an effect on a particular dependent variable. Random assignment was used to assign students to either the treatment condition (e.g., the metacognitive- and critical-thinking-based prime words) or the control condition (e.g., the neutral prime words). Finally, random assignment, the study procedures, and the statistical analyses controlled for extraneous variables that may have provided an alternative explanation for the results.

Participants

Participants were undergraduate students who were enrolled in introductory psychology courses at a large public university in the Midwest. Participants were recruited on the basis of the introductory psychology coordinator's willingness to let the introductory psychology students (excluding the honors section students) participate in the present study. Once the introductory psychology coordinator consented to the students participating, students had the option to consent to participation. Supraliminal priming tasks (e.g., the scrambled sentence task) typically create stronger priming effects than subliminal priming tasks (Bargh & Chartrand, 2000), and the prior literature has found evidence of a moderate effect size for priming analytical thinking with scrambled sentence tasks: $d = .46$ (Swami et al., 2014) and $d = .44$ (Gervais & Norenzayan, 2012). A statistical power analysis for the primary research question indicated that a minimum sample size of approximately $N = 56$ participants (with approximately $n = 28$ participants in each of the treatment and control conditions) was required. Using a criterion for statistical significance

of $\alpha = .05$, and assuming a moderate effect size ($f^2 = .15$) in the population, this would have achieved enough statistical power to reasonably detect (with a probability of 80%) any true differences that may be present between the treatment and control conditions. Similarly, prior literature has found evidence of small-to-moderate effect sizes for the correlations between open-minded, analytic, and intuitive thinking styles and belief in conspiracy theories (Swami et al., 2014). A statistical power analysis for the secondary research question indicated that a minimum sample size of approximately $N = 119$ participants was required. Using the same criterion for statistical significance as above and assuming a moderate effect size in the population, this would have achieved enough statistical power to reasonably detect with the same probability any true differences between personality traits. As some participants would have to be excluded for various reasons (e.g., not making an effortful attempt on the priming task or the misconceptions test, demonstrating awareness of the priming task's intent on the funneled debriefing questions), a sample size ranging between $N = 185$ to $N = 200$ was sought.

Although $N = 196$ participants signed up and received credit for participating in this study, a sample size of only $N = 184$ was achieved (i.e., the total number of participants who at least began the study via Qualtrics). This occurred despite data collection taking place over one-and-a-half semesters, which was longer than initially anticipated and the maximum amount of time in which introductory psychology students were permitted to participate in this study due to study-pool-use restrictions. This was largely due to far fewer introductory psychology students completing their research study participation credits during the current year, along with the fact that participants received credit for merely signing up for the study via the research management system, and there was no mandate that they actually had to complete the study to receive credit. Hence, many participants exploited this, receiving credit but not completing the study.

Within the analytic sample ($N = 117$ participants) that remained after the data exclusion criteria were fulfilled (see the data exclusion criteria section later in this chapter), 52.1% ($n = 61$) were in the treatment condition (i.e., the priming task with metacognitive- and critical-thinking-based words), and 47.9% ($n = 56$) were in the control condition (i.e., the priming task with neutral words). With data collection occurring across two semesters, 43.6% ($n = 51$) of participants were from the fall semester while 56.4% ($n = 66$) were from the spring semester. In terms of participants' high school psychology course experience, 35.9% ($n = 42$) had taken psychology in high school, while 63.2% ($n = 74$) had not taken such a course in high school.

In terms of demographics, 50.4% ($n = 59$) identified as female, while 48.7% ($n = 57$) identified as male. The average age of participants, constrained to those within the emerging adulthood years, was 19.33 ($SD = 1.62$) years of age. Participants' ethnicities were as follows: 42.7% ($n = 50$) White / Caucasian, 23.1% ($n = 27$) Black / African American, 15.4% ($n = 18$) Hispanic / Latino(a), 12.8% ($n = 15$) multiethnic, and 5.1% ($n = 6$) other ethnicity (e.g., Asian, Middle Eastern). After aggregating ethnicity into two groups (i.e., White / Caucasian and persons of color), 56.4% ($n = 66$) identified as a person of color. The majority of participants were first-years (54.7%, $n = 64$), while 25.6% ($n = 30$) were sophomores, 15.4% ($n = 18$) were juniors, and 2.6% ($n = 3$) were non-traditional students (i.e., in their fifth year or some other student category). Finally, 37.6% ($n = 44$) were first-generation college students, while 61.5% ($n = 72$) were continuing-generation students.

Instruments

Priming Manipulation

The treatment prime (e.g., the metacognitive- and critical-thinking-based words) as well as the control prime (e.g., the neutral words) were both in the form of a supraliminal, semantic prime. In comparison to the neutral control prime, the treatment prime was designed to influence participants in terms of some facets that are an important part of metacognition and critical thinking. Both the treatment and control prime were in the form of a modified scrambled sentence task. This scrambled sentence, semantic priming technique, developed over 40 years ago (Srull & Wyer, 1979, 1980), has been used extensively by other researchers (e.g., Bargh et al., 1996; Chartrand & Bargh, 1996; Dennis et al., 2013; Gervais & Norenzayan, 2012; Randolph-Seng & Nielsen, 2007; Sela & Shiv, 2009; Swami et al., 2014; Uhlmann et al., 2011). This priming technique has been shown to activate participants to think analytically without participants' explicit awareness (e.g., Gervais & Norenzayan; Swami et al.; Uhlmann et al.).

To obscure the relationship between the priming manipulation and the subsequent tasks and ensure that participants were unaware of the purpose or possible influence of the priming manipulation on their subsequent information processing (Chartrand & Bargh, 1996; Ferguson & Bargh, 2004), participants were told that they were completing a language skills task (Bargh et al., 1996; Sela & Shiv, 2009). Participants were given 18 sets of five words in a scrambled, nonsense order (see Appendix A). Participants were instructed to construct coherent, grammatical sentences from four of the five scrambled words, not using one word and unscrambling the remaining four words to construct a sentence. The task was designed so that

the prime word should be included in the constructed sentence to achieve a coherent and grammatical sentence. This is because words are typically acknowledged more when one writes the word out in comparison to only reading the word. For 11 of the 18 sentences of the treatment prime manipulation, one word out of the five scrambled words was a metacognitive- and critical-thinking-oriented word. The other seven sentences for the treatment prime manipulation had neutral words identical to some of those of the control prime manipulation which had all neutral words. Bargh and Chartrand's (2000) sample scrambled sentences tasks had the following ratios: a test with 15 words in total has eight prime words and seven neutral words (approximately 53% prime words), while a test with 30 words in total has 22 prime words and eight neutral words (approximately 73% prime words). Hence, for the present study with 18 words in total, 11 of those being treatment prime words, seven neutral words should be appropriate because it produces a ratio (approximately 61% prime words) in between those of Bargh and Chartrand's two sample tasks.

As previous researchers have done (e.g., Dennis et al., 2013), to achieve semantically neutral words in terms of their emotional charge, all words for the treatment and control prime manipulation were selected from the *Affective Norms for English Words (ANEW)*; Bradley & Lang, 1999). The *ANEW* is a standardized set of normative emotional ratings for a large number of selected words in the English language (Bradley & Lang, 1999). These words are semantically and emotionally neutral in that they are not positively or negatively emotionally charged (Krestar & Lennan, 2019). According to Krestar and Lennan, words with *ANEW* valence ratings of four to six on a scale from one to nine and a low- to middle-range arousal level with *ANEW* ratings of less than seven on a scale from one to nine are considered to be semantically and emotionally neutral words.

Psychological Misconceptions Test

The introductory psychology students' ability to dispel common psychological myths and misconceptions was measured with Gardner and Brown's (2013) *Test of Contemporary Misconceptions in Psychology* (TCMP; see Appendix B). The TCMP, a Likert-type scale, was designed to measure introductory psychology students' level of belief in common psychological misconceptions. This test was based on Lilienfeld et al.'s (2010b) book, titled *50 great myths of popular psychology: Shattering widespread misconceptions about human behavior*. The TCMP is a 55-item questionnaire that examines 11 psychological myth and misconception topic areas: brain and behavior, development and aging, memory, intelligence and learning, consciousness, emotion and motivation, social psychology, personality, mental illness, psychology and law, and psychological treatment. Each of these topic areas are assessed with five items. Approximately one-half of the items are constructed as true statements and approximately the other half of the items are constructed as false statements. The response options for these items consist of "completely false," "mostly false," "partly false and partly true," "mostly true," and "completely true." Respondents also have the option to select "don't know" for each item. According to Bensley and Lilienfeld (2015), Gardner and Dalsing (1986), who used a misconceptions test similar to the one used here, discarded the "don't know/no opinion" responses. Hence, in the present study, responses of "don't know" were treated as missing, not as incorrect, because those who endorse the false statements or reject the true statements would have provided the incorrect response. However, the TCMP is not scored in terms of correct versus incorrect responses, but rather scored as participants' overall mean level of endorsement of psychological myths and misconceptions. The range of response options, including Gardner and Brown's addition of the

“don’t know” response option, indicate good methodological construction of this misconceptions test because the lack of these considerations in previous tests (e.g., Gardner & Dalsing, 1986; Vaughan, 1977) has led to methodological concerns for those tests.

The TCMP (2013) has been evaluated in regard to its psychometrics. Gardner and Brown (2013) found no statistically significant difference between the true and false formats of the questionnaire statements in terms of participants’ endorsement of the stated misconceptions. Scores from the TCMP show good evidence of internal consistency reliability, based on Cronbach’s $\alpha = .85$, an alpha-level higher than the .80 criterion recommended by Gardner and Brown. This misconceptions test also shows evidence of good discriminant validity, as Gardner and Brown verified that the TCMP discriminates the misconceptions between the major subfields of psychology.

Personality Test

The introductory psychology students’ personality traits were measured with DeYoung et al.’s (2007) *The Big Five Aspects Scale* (BFAS; see Appendix C). The BFAS, which measures the 10 aspects, or factors, of the Big Five personality traits, is a public domain instrument producing reliable and valid scores. The BFAS was based on two other instruments, the NEO-PI-R (Costa & McCrae, 1992) and the Abridged Big Five Circumplex scales from the International Personality Item Pool (AB5C-IPIP; Goldberg, 1999), both designed to assess individuals’ personality traits on the Big Five. The NEO-PI-R was selected because it is the most widely used instrument to measure the Big Five, and the AB5C-IPIP was selected in order to attain a more thorough coverage of the facet-level traits than the NEO-PI-R alone would provide. Factor

analyses performed on the NEO-PI-R and AB5C-IPIP revealed two distinct, but correlated, factors within each of the Big Five personality traits for a total of 10 factors. These 10 factors can now be assessed with the BFAS without such factor analyses having to be performed. Hence, the BFAS has 10-item subscales that comprise the 10 factors (i.e., 20-item scales that comprise the Big Five personality traits) comprising a 100-item instrument.

DeYoung et al. (2007) examined reliability and validity evidence for scores obtained from the BFAS. Scores from the BFAS show good evidence of internal consistency reliability, determined from a community sample (Cronbach's $\alpha = 0.83$), an initial university sample (Cronbach's $\alpha = 0.81$), and a retest university sample (Cronbach's $\alpha = 0.83$), each higher than the .80 recommendation of DeYoung et al. Scores from the BFAS also show evidence of good test-retest reliability as the scores did not significantly change from DeYoung et al.'s first administration to the second administration, and the average of the test-retest correlations for each of the 10 subscales for the university sample indicates strong correlations between the two administrations ($M = 0.81$, $SD = 0.04$). Additionally, DeYoung et al. were able to validate the BFAS against the NEO-PI-R trait scores and Saucier's (1994) Mini-Markers, which is an adjective marker set for the lexical Big Five showing good validity evidence. DeYoung et al. also found high correlations between the same Big Five traits across the BFAS and Big Five Inventory (BFI; John & Srivastava, 1999), which is a respectable short measure of the Big Five personality traits, making it a good reference against which to validate the BFAS. These validation techniques demonstrated that the BFAS is measuring the standard Big Five personality traits. DeYoung et al. also found evidence of good discriminant validity among the two facets under each of the Big Five personality traits. Finally, the significant demographic differences between two samples (a largely middle-aged, almost entirely White sample of American

community members and an ethnically-diverse sample of young adults enrolled at two Canadian universities) used to construct the BFAS indicate good evidence of discriminant validity based on a diverse English-speaking population.

Procedure

I contacted the coordinator of PSYC 102 (Introduction to Psychology) via email with a request for undergraduate students enrolled in the course to participate (see Appendix E). Once the coordinator agreed, instructors encouraged their students to participate by offering course credit. Students were then able to sign up for and participate in the study through the university's SONA research management system that contained the link to electronically complete the study's tasks. As the introductory psychology students' research participation was lower than expected in the fall semester, data collection continued into the spring semester. This study was active in the SONA system for seven weeks in the fall semester, from October 19 to December 4, 2020 and for over 15 weeks in the spring semester from January 13 to April 23, 2021. Qualtrics, which was set to anonymize responses so that personal participant information (e.g., email or IP addresses) was not recorded, hosted the present study's materials: the experimental priming manipulation (scrambled sentence task), psychological misconceptions test (TCMP, 2013), personality measure (BFAS, 2007), demographic questions, and funneled debriefing procedure. All items in Qualtrics were set to be forced-response items, with a "prefer not to answer" response option available for all demographic items. Participants were randomly assigned to one of two conditions: treatment or control condition. Random assignment was achieved through the randomizer feature in Qualtrics, specifying uniform presentation of the treatment and control

conditions across participants. This randomly assigned each participant to either the treatment or control condition experimental manipulation with sample sizes for each condition being approximately equal. Due to there being positively- and negatively-worded items that are contradictory in nature (e.g., “sympathize with others’ feelings” versus “am indifferent to the feelings of others”), items from the BFAS were particularly formatted to be interspersed independently from the TCMP, and not kept combined under shared subheadings for administration. However, this is not a problem for the TCMP, so items from the TCMP were maintained under shared subheadings for administration, although the subheadings were not presented to participants.

Participants first were presented with an informed consent page that they read and marked the appropriate box as to their willingness or unwillingness to participate in the study (see Appendix F). Once consent was provided, participants were prompted to complete either the treatment or control scrambled sentence task (accomplished via the randomizer feature in Qualtrics), and this served as the experimental priming manipulation (see Appendix A). Qualtrics was set to only allow participants to proceed if, ideally, all sentences had been unscrambled, but realistically, participants could enter any text into the text boxes to proceed. This was anticipated to take participants approximately 10 minutes to complete. Participants in the treatment condition were presented with the experimental priming manipulation, which contained the metacognitive- and critical-thinking-oriented words. Participants in the control condition were presented with the control prime, which contained only neutral words. After the scrambled sentence task had been completed, participants were instructed to begin the TCMP (2013; see Appendix B), which was anticipated to take participants approximately 10 minutes to complete. After completing the TCMP, participants were instructed to begin the BFAS (2007; see

Appendix C), which was also anticipated to take participants approximately 10 minutes to complete. Once the BFAS was completed, participants were asked to provide some demographic information (see Appendix D), such as their gender, age, ethnicity, year in school, college-generation status, and high school psychology course experience. Those who chose not to participate by checking the appropriate box on the informed consent page were automatically directed out of the web survey.

Finally, once all participants completed the TCMP (2013), BFAS (2007), and demographic items, they were presented with Bargh and Chartrand's (2000) funneled debriefing procedure, with a small modification to question seven to make it more relevant to the present study (see Appendix G). Funneled debriefing procedures have been used extensively by other researchers conducting supraliminal priming research (e.g., Bargh et al., 1996; Chartrand & Bargh, 1996; Gervais & Norenzayan, 2012; Randolph-Seng & Nielsen, 2007; Sela & Shiv, 2009; Srull & Wyer, 1979, 1980; Swami et al., 2014; Uhlmann et al., 2011). Funneled debriefing is necessary to ensure that participants are unaware of the purpose or possible influence of the priming manipulation on their subsequent information processing (Bargh & Chartrand, 2000; Chartrand & Bargh, 1996; Ferguson & Bargh, 2004). This entailed questions designed to probe participants' awareness and suspicions (Bargh & Chartrand, 2000; Ferguson & Bargh, 2004).

After participants completed the funneled debriefing procedure, they were thanked for their participation. Once the time period ended for participation, all participants were sent a debriefing letter that explained the nature of the study in more detail (see Appendix H). Also, this debriefing letter contained the answers to the misconceptions test. The full debriefing was delayed to ensure that initial participants' awareness of the true purpose of this study did not influence later participants' awareness and behavior due to communication between participants.

In its entirety, participants took on average approximately 41 minutes to complete all of the experimental tasks. However, because the mean is sensitive to extreme values, which were evident here because some participants discontinuously-processed the experimental tasks, largely inflating and positively skewing the amount of time required to complete the study, the median amount of time to complete the experimental tasks, which was approximately 30 minutes, is likely a more appropriate estimate. Similarly, while the mean amount of time that participants in the treatment condition was longer ($M = 46.37$, $SD = 46.63$) due to more extreme values in that condition than those in the control condition ($M = 35.54$, $SD = 19.19$), the median amount of time for both groups again was approximately 30 minutes.

Analysis

Initial data cleaning and some data setup, coding, and scoring were performed in the Statistical Package for the Social Sciences (SPSS). The remaining data setup and coding, along with the main statistical analyses, were performed in the R statistical software application (version 4.0.3).

Data Exclusion Criteria

Data from participants who did not complete the experimental tasks within a single day or did not complete a large portion or all of the experimental tasks were excluded from analyses. A total of three cases failed to complete all of the experimental tasks within a single day, i.e., 24 hours. A total of 26 cases failed to complete a large portion or all of the experimental tasks, only

completing the informed consent. These cases consequently were removed. Furthermore, due to the developmental perspective that this study took, participants who were not within the emerging adulthood years (i.e., 18 to 25 years of age; Arnett, 2015) were excluded from analyses. This resulted in two cases being removed from the data set.

Additionally, although there are no recommendations in the literature, participants who did not make an effortful attempt on the priming scrambled sentence task were excluded. Participants who only correctly unscrambled nine or fewer (out of 18 total) sentences were considered as having not made an effortful attempt and excluded from analyses. Participants who correctly unscrambled 10 or more (out of 18 total) sentences were considered as having made an effortful attempt and included in analyses. A total of 24 cases failed to correctly complete the priming task in its entirety, either rewriting all five words, instead of unscrambling four of the five words provided, or filling in nonsense (e.g., “1,” “he”) for each item instead of the unscrambled words. Beyond this, there were still a total of 10 cases to remove due to those participants failing to make an effortful attempt on the priming task as defined above.

Similarly, participants who did not make an effortful attempt on the TCMP (2013) were excluded from particular analyses. Participants who responded with the “don’t know” option for over half of the items (i.e., 28 or more items out of 55 total items) were considered as having not made an effortful attempt and excluded from particular analyses. Participants who responded with the “don’t know” option for less than half of the items (i.e., 27 or fewer items out of the 55 total items) were considered as having made an effortful attempt and included in all analyses. These exclusion criteria pertaining to the use of the “don’t know” option were applied to all regression analyses except for analyses that examined the frequency that participants selected the “don’t know” option. This resulted in a total of seven cases being removed from some analyses.

Also, it was determined that participants with a genuine awareness of the relationship between the priming manipulation and the subsequent experimental tasks according to the funneled debriefing should not be included in the analyses. This includes any participant who answers a question in the funneled debriefing that was “in the ballpark” for how the priming manipulation could have influenced their responses. However, if there is a high proportion of participants excluded due to their demonstrating genuine awareness of the priming manipulation’s influence on their responses (i.e., approximately five percent or more), analyses should include all participants as it is likely that even participants who did not indicate awareness on the funneled debriefing did in fact have some level of awareness (Bargh & Chartrand, 2000). Because only one participant demonstrated genuine awareness of the purpose of the priming manipulation, this case was removed from all analyses.

Had it been possible to maintain an adequate sample size, those who completed the experimental tasks in an unreasonably brief amount of time (i.e., 15 minutes or less for a study that should require approximately 45 minutes to complete) were going to be removed. However, an adequate sample size could not be maintained, so these participants were not excluded. Also, there was no reason to believe that these participants exerted lower effort than those who took two or more hours to complete the experimental materials and had likely discontinuously-processed the study, as Höhne and Schlosser (2018) suggest, by switching to other browser tabs, checking email, and so forth. These distractions could have easily decreased any potential effectiveness of the priming manipulation similar to speeding through the tasks. Therefore, per the data exclusion criteria outlined above, including one participant who did not consent to participate, a total of $n = 67$ participants were excluded from all analyses, not including those excluded from only a portion of the analyses from the TCMP “don’t know” response option

exclusion criteria. Hence, the analytic sample size consisted of a maximum of $N = 117$ participants.

Data Setup and Coding

To apply the above exclusion criteria, the priming task was scored such that sentences unscrambled correctly earned a score of one and sentences unscrambled incorrectly earned a score of zero. Before beginning any statistical analyses, the true statements of the TCMP were reverse-scored so that higher scores represented participants' stronger beliefs in the assessed psychological misconceptions (Gardner & Brown, 2013). For the main multiple linear regression analyses that addressed the research questions, responses of "don't know" were treated as missing. Missing data produced from the selection of the "don't know" option were not imputed. The composite TCMP scores were computed as the mean of the completed item scores. Also, the items written in opposition to the personality trait listed of the BFAS (2007) were reverse-scored so that higher scores represented participants' stronger disposition towards that personality trait. The composite BFAS subscale scores were computed as the mean of the item scores.

For the additional hierarchical multiple linear regression analyses examining participants' selection of the potentially metacognitively-advanced response of "don't know" for items in which they lack the knowledge necessary to judge the truth or falsity of the item presented, participants were assigned a score indicating how frequently they selected the "don't know" option. This composite score would constitute the sum of how frequently the "don't know" option was selected across the 55-item TCMP (2013).

For the additional independent-samples *t*-test analysis examining whether the treatment

group differed from the control group in their responses to true versus false items on the psychological misconceptions test, two composite scores were computed from the TCMP (2013): a composite score for the true items and a composite score for the false items. After these composite scores were computed, a difference score between participants' composite scores for the true and false items of the TCMP was computed for each participant.

Finally, descriptive statistics were computed to summarize central tendency, variability, and distributional characteristics. In addition, reliability analyses were conducted. For data from the priming task, which is a cognitive / ability task that is coded as correct or incorrect, the Kuder-Richardson Formula 20 (KR-20; Kuder & Richardson, 1937) coefficient was computed. Although misconceptions tests typically are viewed as measuring a unidimensional construct, the statistical analyses conducted in this current study used not only participants' overall score on the TCMP (2013), but also the discrepancy between participants' scores on the true versus the false items of the TCMP. Hence, for data from the TCMP, which is coded on a five-point response scale, three values of Cronbach's alpha were computed (i.e., one for the data from the overall TCMP, one for the data from the true items of the TCMP, and one for the data from the false items of the TCMP). For data from the BFAS (2007), 10 values of Cronbach's alpha were computed (i.e., one value for the data for each of the 10 personality trait subscales). Data screening and diagnostic analyses were also performed to assess the data and discern any potential problems, such as missing values, outliers, or violations of assumptions for the planned statistical analyses. Missing values on the demographic variables were multiply-imputed. Analyses were performed including and excluding cases identified as multivariate outliers. After these preliminary analyses were conducted and any potential problems were adequately dealt with, the main inferential statistical analyses were conducted.

Statistical Analyses

Multiple linear regression was used to assess the research questions. The priming of metacognitive and critical thinking skills as well as belief in psychological myths and misconceptions were tested with regard to gender, age, ethnicity, year in school, and college-generation status. Therefore, these potential covariates were statistically controlled for. Because a large number of introductory psychology students did not complete their research participation credits in Fall 2020 when data collection began, it was necessary to continue data collection into the Spring 2021 semester to attain an adequate sample size. Hence, participants came from two different semesters of classes (i.e., fall versus spring), and along with that, two different time points of the semester (i.e., the second half of the fall semester several weeks after priming had been taught versus the entire spring semester where no explicit priming instruction took place). Therefore, an independent-samples *t*-test was performed to assess whether there were pre-existing differences among the two subsamples (i.e., fall versus spring semester) on the two main outcomes examined in the regression analyses. Analyses revealed no semester group differences in terms of participants' endorsement of psychological myths and misconceptions ($p = .409$) or the "don't know" response option ($p = .892$); hence, participants were treated as a single group.

Furthermore, for the TCMP (2013), non-universal qualifiers (e.g., "most" and "some") may cue participants that these statements are true, while universal qualifiers (e.g., "only" and "all") may cue participants that these statements are false, regardless of the actual truth or falsity of the statement in question. Although items with extreme wording are necessary to distinguish between participants polarized on a construct versus those more moderate, Spector et al. (1997) found that items with extreme wording are not frequently endorsed by participants. It has been

found that the wording of items is interpreted literally, consequently making it unlikely that participants will strongly endorse items with extreme words (e.g., “always,” “never”) that are not completely true (Nye et al., 2010). Further, McPherson and Mohr (2005) found that, as the wording of an item becomes more extreme, an increasing number of participants will not agree with either a positively- or negatively-worded item; however, as the wording becomes less extreme, an increasing number of participants will agree with items worded in either direction. Although extreme words within survey items influence participants’ response processes, these effects are small and proportional to the percentage of items that use extreme wording within the survey instrument. This latter finding is of particular importance because extreme items are typically used in conjunction with items that use more moderate wording, which is the case with the TCMP (2013). Hence, any effects of using extreme wording are unlikely to substantially influence the instrument’s properties (Nye et al., 2010). Nevertheless, these wording effects do not appear to have been examined in terms of psychological misconceptions tests. A generalized linear mixed model (GLMM) with an ordinal link function was fitted to determine whether responses to statements with universal or non-universal qualifiers of the TCMP differed significantly from statements with no qualifiers in terms of participants’ endorsement of common psychological misconceptions. However, regardless of whether there were significant differences, there was no need to statistically control for these effects in this study by employing statement type as a covariate because every participant received the same misconceptions test with identical qualifiers used per each item. Hence, any qualifier differences were controlled for in the research design.

To address RQ1, a series of multiple linear regression models were used to predict participants’ endorsement of common psychological myths and misconceptions from their

exposure to the treatment priming manipulation, after controlling for several covariates. These statistical analyses aimed to show whether or not participants in the treatment condition (i.e., those exposed to the metacognitive and critical-thinking prime words) showed significantly reduced endorsement of psychological myths and misconceptions, when compared to the control group. The outcome variable for this set of regression analyses was participants' endorsement of common psychological myths and misconceptions. To assess whether there was an effect of the priming manipulation, after controlling for several covariates, standard and hierarchical regression models were used. To assess whether there was an effect of the priming manipulation after controlling for demographic covariates, the predictors in the first regression model included gender, age, ethnicity, year in school, and college-generation status (defined as first-generation and continuing-generation college students) along with the binary indicator of the priming manipulation condition. To assess whether there was an effect of the prime, after controlling for personality traits and demographic covariates, hierarchical regression models were used. The first model included demographics. The second model included demographics and added the personality trait subscale scores as predictors. The full model added the priming manipulation condition indicator variable, in addition to the demographic and personality trait predictors. Moreover, to address RQ1, the above regression analyses were repeated using the frequency of the "don't know" response on the TCMP (2013) as the outcome variable.

To address RQ2, hierarchical multiple linear regression models were used to predict participants' endorsement of common psychological myths and misconceptions from their personality traits, after controlling for several demographic covariates. In these analyses, the outcome variable was participants' endorsement of common psychological myths and misconceptions. The reduced model included the same demographic variables indicated in the

previously-described regression models as predictors. The full model included the same set of demographic variables, along with the personality trait subscale scores. Also, to address RQ2, the above regression analyses were repeated using the frequency of the “don’t know” response on the TCMP (2013) as the outcome variable.

For each regression, the Pratt index was calculated for each predictor as an indicator of relative importance. To assess effect size, R^2 was computed to determine the magnitude and practical significance of the observed effects.

Finally, an independent-samples *t*-test was performed on the computed difference scores (between the true and false items of the TCMP (2013)) to determine whether the treatment group differed significantly from the control group in the type of error (i.e., rejecting the true items or accepting the false items) made on the psychological misconceptions test.

CHAPTER 4

RESULTS

Data Screening

Reliability

KR-20 analyses produced low reliability evidence for the priming task treatment items ($\alpha = 0.38$) and control items ($\alpha = 0.57$) with some items negatively correlated with the total scale. Similarly, Cronbach's alpha analyses produced low reliability evidence for the TCMP ($\alpha = 0.56$) and TCMP true items only ($\alpha = 0.57$), again with several items negatively correlating with the score total. Although acceptable reliability evidence was found for the TCMP false items ($\alpha = 0.77$), some items still negatively correlated with the total score. Moreover, there was a mix of reliability evidence for the BFAS personality trait subscale items: withdrawal ($\alpha = 0.77$), volatility ($\alpha = 0.89$), compassion ($\alpha = 0.80$), politeness ($\alpha = 0.62$), industriousness ($\alpha = 0.82$), orderliness ($\alpha = 0.72$), enthusiasm ($\alpha = 0.79$), assertiveness ($\alpha = 0.77$), intellect ($\alpha = 0.78$), and openness ($\alpha = 0.62$), with some withdrawal, politeness, and openness items negatively correlating with the subscale scores.

Missing Data

Although there were no missing data on the personality trait items as measured by the BFAS (2007), there were missing data on the psychological misconceptions items as measured by the TCMP (2013) and demographic items. Little's (1998) test applied to all of the predictors and outcomes (i.e., semester, prime condition, 10 personality trait subscale scores, demographics, and TCMP total score, "don't know" score, and difference score) showed that missing values on the demographic items were missing completely at random (MCAR; $p = .689$). However, Little's test applied to only the misconceptions test items showed that missing values produced from participants selecting the "don't know" response option were not MCAR ($p < .001$).

When data are not MCAR, single-value imputation or listwise deletion of cases with missing data can bias the results. Because the majority of participants selected the "don't know" response at some point, listwise deletion of the cases with missing data was not an option, particularly with the sample size that remained after the exclusion criteria were met. Additionally, because selecting "don't know" may have been the metacognitively-advanced response if participants recognized that they did not possess the knowledge required to judge the truth or falsity of the TCMP (2013) statements, it would also not be appropriate to multiply impute the missing values, even though multiple imputation can be used when data are not MCAR. However, a composite score was computed from the TCMP for every participant, so no cases were deleted due to the missing data on this instrument not being multiply imputed. Nevertheless, although missing values on the demographics were MCAR, missing values on those items were multiply imputed, rather than listwise deleted, due to sample size concerns.

Descriptive Analyses

Table 1 shows the descriptive statistics for the prime task score as well as the TCMP (2013) composite score, true and false item scores, difference score, and “don’t know” score by prime condition.

Table 1

Descriptive Statistics for Prime Task and TCMP Scores by Prime Condition ($N = 117$)

Variable	<i>Treatment</i>			<i>Control</i>		
	<i>M</i>	<i>SD</i>	<i>SE</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Prime Task Score	15.02	2.18	0.28	15.11	2.15	0.29
TCMP Composite Score	2.93	0.23	0.03	2.91	0.24	0.03
TCMP True Item Score	2.90	0.25	0.03	2.95	0.37	0.05
TCMP False Item Score	2.95	0.39	0.05	2.88	0.47	0.06
TCMP Difference Score	-0.05	0.47	0.06	0.07	0.68	0.09
TCMP “Don’t Know” Score	9.05	10.46	1.34	9.50	10.05	1.34

Note. The treatment received metacognitive- and critical-thinking-based words. The control received neutral words. The prime task was scored out of 18, with the minimum acceptable number correct being 10 (per the data exclusion criteria). The TCMP (2013) was measured on a scale from 1 (completely false) to 5 (completely true), with higher scores representing greater endorsement of psychological misconceptions. The descriptive statistics reported for the TCMP “don’t know” score are before univariate outliers on that variable were truncated.

At the sample level, the mean value on the priming task score was higher for the control condition than the treatment condition; however the difference was very small. Also, the mean values on the TCMP (2013) composite and false item scores were technically higher for the treatment than the control condition, suggesting that the treatment condition actually endorsed

psychological misconceptions to a greater extent than the control. In contrast, the mean values for the TCMP true item and difference scores were higher for the control than the treatment condition, suggesting that those in the control condition endorsed a greater number of facts validated by psychological science and hence fewer misconceptions. However, these differences were very small. Furthermore, the control condition, on average, responded with “don’t know” on the TCMP to a greater extent than the treatment condition.

Table 2 shows the descriptive statistics for the TCMP (2013) composite score by participant demographics.

Table 2
Descriptive Statistics for TCMP Composite Score by Demographics

Demographic		<i>n</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
Gender	Female	59	2.97	0.21	0.03
	Male	57	2.87	0.26	0.03
Ethnicity	Persons of Color	66	2.98	0.20	0.02
	White / Caucasian	50	2.83	0.26	0.04
Year Level of College	First Year	64	2.93	0.21	0.03
	Sophomore	30	2.98	0.23	0.04
	Junior	18	2.81	0.31	0.07
College-Generation Status	First-Generation	44	2.94	0.19	0.03
	Continuing-Generation	72	2.90	0.26	0.03
High School Psychology	Psychology Course	42	2.93	0.21	0.03
	No Psychology Course	74	2.92	0.25	0.03

Note. For year level of college, only a few participants indicated that they were non-traditional students (i.e., “fifth year” or “other”). Hence, descriptive statistics for those categories are not reported here because they would be a single participant’s values for at least one category.

At the sample level, the mean value of psychological misconception endorsement was higher among females (compared to males), persons of color (compared to White / Caucasians), sophomores (compared to first-years and juniors), first-generation college students (compared to continuing-generation students), and those who had previously taken a psychology course in high school (compared to those who had not). However, the mean differences were small.

Table 3 shows the descriptive statistics for the outcome variables (i.e., TCMP composite, TCMP “don’t know,” and TCMP difference scores) for the non-aggregated ethnic groups.

Table 3
Descriptive Statistics for Outcome Variables by Ethnic Groups

Ethnic Group	<i>n</i>	<i>TCMP Composite Score</i>			<i>TCMP “Don’t Know” Score</i>			<i>TCMP Difference Score</i>		
		<i>M</i>	<i>SD</i>	<i>SE</i>	<i>M</i>	<i>SD</i>	<i>SE</i>	<i>M</i>	<i>SD</i>	<i>SE</i>
White / Caucasian	50	2.83	0.26	0.04	9.30	9.31	1.32	0.08	0.52	0.07
Persons of Color	66	2.98	0.20	0.02	9.26	11.01	1.36	-0.04	0.63	0.08
Black / African-American	27	2.97	0.18	0.04	11.52	12.72	2.45	-0.25	0.60	0.12
Hispanic / Latino(a)	18	2.95	0.16	0.04	7.44	10.72	2.53	0.31	0.70	0.16
Multiethnic	15	3.00	0.23	0.06	8.60	8.12	2.10	-0.11	0.46	0.12
Other	6	3.07	0.26	0.11	6.17	10.32	4.21	0.05	0.57	0.23

Note. The TCMP (2013) was measured on a scale from 1 (completely false) to 5 (completely true), with higher scores representing greater endorsement of psychological misconceptions. The descriptive statistics reported for the TCMP “don’t know” score are before univariate outliers on that variable were truncated.

At the sample level, the mean value on the TCMP (2013) composite score was highest among those in the other ethnic group category, with the mean value decreasing among

multiethnic, Black / African-American, Hispanic / Latino(a), and White / Caucasian individuals, suggesting that individuals from other and multiple ethnic groups endorsed psychological misconceptions to the greatest extent. The mean value on the TCMP “don’t know” score was highest among Blacks / African-Americans, with the mean value decreasing among White / Caucasian, multiethnic, Hispanic / Latino(a), and other ethnic group individuals, suggesting that Blacks / African-Americans tend to endorse the potentially-metacognitively-advanced response of “don’t know” on the psychological misconceptions test to the greatest extent. However, the mean value on the TCMP difference score was highest among Hispanics / Latino(a)s, with the mean value decreasing among White / Caucasian, other ethnic group, multiethnic, and Black / African-American individuals, suggesting that Hispanics / Latino(a)s endorsed the greatest number of facts validated by psychological science whereas Blacks / African-Americans endorsed the greatest number of misconceptions.

Table 4 shows the descriptive statistics for the 10 personality trait subscale scores for the analytic sample as a whole. Overall, participants’ dispositions were neutral in terms of withdrawal, less predisposed to volatility, and more predisposed to all of the remaining personality traits (i.e., compassion, politeness, industriousness, orderliness, enthusiasm, assertiveness, intellect, and openness).

Examination of the histograms, boxplots, and skewness statistics indicated positive skewness for age, year in school, and the TCMP (2013) “don’t know” score and negative skewness for the TCMP composite score; however, this skewness was typically not substantial per the skewness statistics. The distributions of most of the personality trait subscale scores and the TCMP difference score were relatively close to normal.

Table 4

Descriptive Statistics for Personality Trait Subscale Scores for the Analytic Sample ($N = 117$)

Variable		<i>M</i>	<i>SD</i>	<i>SE</i>
Neuroticism	Withdrawal	3.01	0.68	0.06
	Volatility	2.86	0.88	0.08
Agreeableness	Compassion	3.85	0.61	0.06
	Politeness	3.86	0.53	0.05
Conscientiousness	Industriousness	3.30	0.70	0.06
	Orderliness	3.55	0.59	0.05
Extroversion	Enthusiasm	3.49	0.65	0.06
	Assertiveness	3.32	0.62	0.06
Openness / Intellect	Intellect	3.41	0.62	0.06
	Openness	3.59	0.54	0.05

Note. Personality traits on the BFAS (2007) were measured on a scale from 1 (strongly disagree) to 5 (strongly agree), with higher scores representing a stronger disposition toward that trait.

Outliers

In terms of univariate outliers, the values observed as potential outliers on each of the continuous variables, if there were any, were within the range of reasonable values. In most cases, the non-normality (as indicated above) and these potential outliers did not pose an issue for the subsequent regression models. Therefore, these values were not truncated. However, for the regression analyses in which the TCMP (2013) “don’t know” score served as the outcome, there were some issues with the data. Despite the data being positively skewed for the TCMP “don’t know” score, there were still four cases that stood out as outliers. These outliers were

truncated by changing the scores to the next highest unit plus one unit.

Cases with a Mahalanobis distance greater than 32.00 were considered as multivariate (MV) outliers. One case constituted a MV outlier. Analyses were performed both with and without this outlier. The statistical conclusions resulting from the main regression analyses changed when this outlier was included versus excluded. Additionally, while the assumptions were not necessarily better met with or without this outlier for the analyses in which the TCMP composite score served as the outcome, the assumptions were slightly better met for an analysis when this outlier was excluded from analyses in which the TCMP “don’t know” score served as the outcome. Therefore, because this MV outlier had a substantial influence on the statistical conclusions and a less substantial but still notable influence on the assumptions, the reported results below are from the analyses in which the MV outlier was removed. With the MV outlier removed from all analyses, in addition to the seven participants removed from analyses in which the TCMP composite score served as the outcome due to the amount of times they selected “don’t know” as well as the four participants removed from analyses in which the TCMP “don’t know” score served as the outcome due to them being observed as influential and problematic cases per the casewise regression diagnostics (to meet the model assumptions), the total sample size resulting for the analytic data set ranged between $N = 109$ to $N = 112$ participants.

Model Assumptions and Other Desirable Attributes

For the three regression analyses in which the TCMP (2013) composite score served as the outcome, the residuals either were normally distributed or close-to-normally distributed, as indicated by the histograms, Q-Q plots, and Shapiro-Wilk tests for normality ($p = .189$; $p = .662$;

$p = .518$). The residuals vs. fitted and scale-location plots showed no evident heteroscedasticity, and formal tests for non-constant variance were not statistically significant ($p = .086$; $p = .717$; $p = .719$). Therefore, both the normality and homoscedasticity of residuals assumptions were met. An examination of the scatterplots of the observed outcome on the predicted outcome (produced from the linear combination of the predictors) showed no excessive curvilinear relationship, so the linearity assumption was supported. Finally, there were no issues with multicollinearity (i.e., excessive correlations among the predictors) because all of the variance inflation factor (VIF) statistics were small (i.e., less than five).

For the three regression analyses in which the TCMP (2013) “don’t know” score served as the outcome, the normality and homoscedasticity of residuals assumptions were initially violated. However, unlike the TCMP composite score, which was only slightly negatively skewed, the TCMP “don’t know” score was more substantially positively skewed with four cases that still clearly were outlying. Therefore, these outliers were truncated; however, model assumptions were still violated. The four cases that were now the truncated outliers were still marked as problematically influential cases on all of the residual plots, including the residuals vs. leverage plot. Therefore, per these casewise regression diagnostics, these four cases were removed. In the subsequent three regression models, while the Shapiro-Wilk tests for normality were still statistically significant ($p < .001$; $p = .001$; $p = .003$), the residuals were close-to-normally distributed as indicated by the histograms and Q-Q plots, and the skewness statistics were not large. Also, while the test for non-constant variance remained statistically significant for the first regression model ($p < .001$), it did not remain significant by the second ($p = .127$) or third ($p = .159$) models, and the residuals vs. fitted and scale-location plots showed no clearly evident heteroscedasticity. Therefore, with these adjustments, both the normality and

homoscedasticity of residuals assumptions were met. An examination of the scatterplots of the observed outcome on the predicted outcome showed no non-linear relationship, so the linearity assumption was supported. Finally, there were no issues with multicollinearity because all of the VIF statistics were small.

Inferential Analyses

Two continuous outcome variables were examined in the subsequent regression models: endorsement of psychological misconceptions as measured by the TCMP (2013) composite score and endorsement of the potentially-metacognitively-advanced “don’t know” response option on the TCMP. A total of 16 predictors were used in the regression models. Prime condition (coded 0 = control condition, 1 = treatment condition) is a categorical, nominal-level variable with control condition as the reference category. The BFAS (2007) measured 10 personality traits (related to the Big Five personality traits) via 10 subscale scores, all of which are continuous variables: withdrawal and volatility (neuroticism), compassion and politeness (agreeableness), industriousness and orderliness (conscientiousness), enthusiasm and assertiveness (extroversion), and intellect and openness (openness / intellect). The five demographic variables included as covariates were gender (coded 1 = male, 2 = female with male as the reference category), age (classified as continuous), ethnicity (coded 1 = White / Caucasian, 2 = persons of color with White / Caucasian as the reference category), year level of college (classified as continuous), and college-generation status (coded as 1 = first-generation college student, 2 = continuing-generation college student with continuing-generation student as the reference category).

Regression Models: Predicting Endorsement of Psychological Misconceptions on TCMP (2013)

The first regression model, which addressed RQ1, was:

$$\begin{aligned} \text{predicted TCMP composite score} = & b_0 + b_1(\text{gender}) + b_2(\text{age}) + b_3(\text{ethnicity}) + b_4(\text{year level}) \\ & + b_5(\text{college-generation status}) + b_6(\text{prime condition}). \end{aligned}$$

This combination of predictors significantly predicted endorsement of psychological misconceptions, $F(6, 102) = 4.807, p < .001$. Although age ($b_2 = -0.011, p = .592$), year level ($b_4 = -0.038, p = .323$), and first-generation student status ($b_5 = -0.011, p = .811$) were not significant covariates, female gender ($b_1 = 0.086, p = .048$) and the persons of color indicator variable for ethnicity ($b_3 = 0.187, p < .001$) both were statistically significant, positive covariates.

Specifically, compared to males and White / Caucasian individuals, females and persons of color, respectively, tended to have a greater endorsement of psychological misconceptions.

However, controlling for these covariates, the treatment prime condition ($b_6 = 0.013, p = .749$) was not a statistically significant predictor of endorsement of psychological misconceptions.

Those in the treatment condition, who received metacognitive- and critical-thinking-based words, did not demonstrate a different level of endorsement of psychological misconceptions than those in the control condition, who received neutral words. Nevertheless, 22.04% of the variation in the endorsement of psychological misconceptions was explained by this set of predictors.

As an indicator of relative importance, the Pratt Index was calculated for each predictor. Important predictors are those with a Pratt Index greater than $1/2P = 0.083$, where P = the number of predictors in the regression model. With a Pratt Index of 0.200 for female gender and

0.638 for the persons of color indicator variable for ethnicity, these predictors were not only statistically significant but also relatively important compared to the other predictors.

The second regression model, which addressed RQ2, was:

$$\text{predicted TCMP composite score} = b_0 + b_1(\text{gender}) + b_2(\text{age}) + b_3(\text{ethnicity}) + b_4(\text{year level}) \\ + b_5(\text{college-generation status}) + b_{6-15}(\text{personality traits}).$$

This combination of predictors significantly predicted endorsement of psychological misconceptions, $F(15, 93) = 5.461, p < .001$. Although female gender ($b_1 = 0.028, p = .546$), age ($b_2 = 0.017, p = .368$), year level ($b_4 = -0.066, p = .069$), and college-generation status ($b_5 = -0.033, p = .443$) were not significant covariates, the persons of color indicator variable for ethnicity ($b_3 = 0.185, p < .001$) was a statistically significant, positive covariate. Again, compared to White / Caucasian individuals, persons of color tended to have a greater endorsement of psychological misconceptions. Controlling for these covariates, the combined set of personality traits statistically significantly predicted endorsement of psychological misconceptions, $F(10, 93) = 4.350, p < .001$. Considered individually, compassion, one of the traits representing agreeableness ($b_8 = -0.105, p = .040$), orderliness, one of the traits representing conscientiousness ($b_{11} = 0.079, p = .0499$), and intellect, one of the traits representing openness / intellect ($b_{14} = -0.177, p < .001$), significantly predicted endorsement of psychological misconceptions. Specifically, as compassion decreased, orderliness increased, or intellect decreased, endorsement of psychological misconceptions increased. The other personality traits (withdrawal: $b_6 = 0.073, p = .169$; volatility: $b_7 = 0.003, p = .917$; politeness: $b_9 = 0.065, p = .230$; industriousness: $b_{10} = 0.059, p = .208$; enthusiasm: $b_{12} = 0.029, p = .515$; assertiveness: $b_{13} = 0.093, p = .067$; openness: $b_{15} = 0.017, p = .680$) were not significant

predictors. However, 46.83% of the variation in the endorsement of psychological misconceptions was explained by this set of predictors.

In this model, predictors with relative importance are those with a Pratt Index greater than 0.033. With a Pratt Index of 0.298 for the persons of color indicator variable for ethnicity, 0.119 for compassion, 0.115 for orderliness, and 0.298 for intellect, these predictors were not only statistically significant but also relatively important compared to the other predictors.

The third regression model, which addressed RQ1 again, was:

$$\begin{aligned} \text{predicted TCMP composite score} = & b_0 + b_1(\text{gender}) + b_2(\text{age}) + b_3(\text{ethnicity}) + b_4(\text{year level}) \\ & + b_5(\text{college-generation status}) + b_{6-15}(\text{personality traits}) \\ & + b_{16}(\text{prime condition}). \end{aligned}$$

This combination of predictors significantly predicted endorsement of psychological misconceptions, $F(16, 92) = 5.318, p < .001$. Again, female gender ($b_1 = 0.027, p = .549$), age ($b_2 = 0.020, p = .299$), year level ($b_4 = -0.067, p = .065$), and college-generation status ($b_5 = -0.027, p = .530$) were not significant covariates, but the persons of color indicator variable for ethnicity ($b_3 = 0.188, p < .001$) was a statistically significant, positive covariate, with persons of color typically exemplifying greater endorsement of psychological misconceptions than their White / Caucasian peers. Also, in parallel with the previous model, compassion ($b_8 = -0.100, p = .049$), orderliness ($b_{11} = 0.094, p = .023$), and intellect ($b_{14} = -0.183, p < .001$) significantly predicted endorsement of psychological misconceptions. As compassion decreased, orderliness increased, or intellect decreased, endorsement of psychological misconceptions increased. The other personality trait predictors, again, did not significantly predict endorsement of psychological misconceptions (withdrawal: $b_6 = 0.073, p = .164$; volatility: $b_7 = -0.003, p = .924$; politeness: b_9

= 0.063, $p = .247$; industriousness: $b_{10} = 0.060$; $p = .199$; enthusiasm: $b_{12} = 0.023$, $p = .601$; assertiveness: $b_{13} = 0.089$, $p = .080$; openness: $b_{15} = 0.015$; $p = .714$). Controlling for these covariates, the treatment prime condition ($b_{16} = 0.057$, $p = .145$) was not a statistically significant predictor of endorsement of psychological misconceptions. Those who received metacognitive- and critical-thinking-based words did not demonstrate a different level of endorsement of psychological misconceptions than those who received neutral words. Nevertheless, 48.05% of the variation in the endorsement of psychological misconceptions was explained by this complete set of predictors.

In this model, predictors with relative importance are those with a Pratt Index greater than 0.031. With a Pratt Index of 0.294 for the persons of color indicator variable for ethnicity, 0.110 for compassion, 0.133 for orderliness, and 0.301 for intellect, these predictors were statistically significant and relatively important compared to the other predictors. See Table 5 for a summary of these and subsequent regression models.

Regression Models: Predicting Endorsement of “Don’t Know” on TCMP (2013)

The fourth regression model, which addressed RQ1, was:

$$\begin{aligned} \text{predicted TCMP “don’t know” score} = & b_0 + b_1(\text{gender}) + b_2(\text{age}) + b_3(\text{ethnicity}) + b_4(\text{year level}) \\ & + b_5(\text{college-generation status}) + b_6(\text{prime condition}). \end{aligned}$$

This combination of predictors did not significantly predict endorsement of the potentially-metacognitively-advanced response of “don’t know” on the psychological misconceptions test, $F(6, 105) = 1.421$, $p = .214$. Female gender ($b_1 = -1.539$, $p = .337$), age ($b_2 = -1.138$, $p = .121$),

Table 5

Summary of Regression Models: Excluding Outlier

<i>Predictors</i>	Regression 1 (RQ1)			Regression 2 (RQ2)			Regression 3 (RQ1)			Regression 4 (RQ1)			Regression 5 (RQ2)			Regression 6 (RQ1)		
	<i>Estimates</i>	<i>std. Error</i>	<i>p</i>	<i>Estimates</i>	<i>std. Error</i>	<i>p</i>	<i>Estimates</i>	<i>std. Error</i>	<i>p</i>	<i>Estimates</i>	<i>std. Error</i>	<i>p</i>	<i>Estimates</i>	<i>std. Error</i>	<i>p</i>	<i>Estimates</i>	<i>std. Error</i>	<i>p</i>
Intercept	3.04	0.34	<0.001	2.17	0.50	<0.001	2.10	0.50	<0.001	28.75	12.70	0.026	6.91	20.18	0.733	8.91	20.24	0.661
Gender (Female)	0.09	0.04	0.048	0.03	0.05	0.546	0.03	0.05	0.549	-1.54	1.60	0.337	-2.56	1.82	0.164	-2.50	1.82	0.173
Age	-0.01	0.02	0.592	0.02	0.02	0.368	0.02	0.02	0.299	-1.14	0.73	0.121	-1.29	0.76	0.092	-1.34	0.76	0.081
Ethnicity (Persons of color)	0.19	0.05	<0.001	0.19	0.04	<0.001	0.19	0.04	<0.001	-1.00	1.71	0.560	-1.34	1.66	0.421	-1.34	1.65	0.420
Year Level of College	-0.04	0.04	0.323	-0.07	0.04	0.069	-0.07	0.04	0.065	2.33	1.41	0.100	3.06	1.40	0.032	2.98	1.40	0.036
College-Generation Status (First-generation student)	-0.01	0.05	0.811	-0.03	0.04	0.443	-0.03	0.04	0.530	-2.36	1.77	0.187	-0.81	1.70	0.634	-1.01	1.70	0.557
Prime Condition (Treatment)	0.01	0.04	0.749				0.06	0.04	0.145	-0.80	1.54	0.607				-1.65	1.53	0.285
Withdrawal (Neuroticism)				0.07	0.05	0.169	0.07	0.05	0.164				-1.27	2.08	0.542	-1.37	2.08	0.512
Volatility (Neuroticism)				0.00	0.03	0.916	-0.00	0.03	0.924				1.44	1.31	0.272	1.66	1.32	0.210
Compassion (Agreeableness)				-0.11	0.05	0.039	-0.10	0.05	0.049				2.89	2.02	0.157	2.78	2.02	0.173
Politeness (Agreeableness)				0.07	0.05	0.230	0.06	0.05	0.246				4.09	2.15	0.060	4.11	2.14	0.058
Industriousness (Conscientiousness)				0.06	0.05	0.208	0.06	0.05	0.199				1.31	1.88	0.487	1.27	1.87	0.501
Orderliness (Conscientiousness)				0.08	0.04	0.050	0.09	0.04	0.023				-3.30	1.56	0.037	-3.68	1.60	0.024
Enthusiasm (Extroversion)				0.03	0.04	0.515	0.02	0.04	0.601				0.75	1.78	0.672	0.86	1.78	0.629
Assertiveness (Extroversion)				0.09	0.05	0.067	0.09	0.05	0.079				0.08	1.96	0.968	0.11	1.96	0.955
Intellect (Openness/Intellect)				-0.18	0.04	<0.001	-0.18	0.04	<0.001				0.63	1.70	0.710	0.84	1.70	0.624
Openness (Openness/Intellect)				0.02	0.04	0.680	0.01	0.04	0.714				-0.44	1.58	0.780	-0.36	1.58	0.820
Observations	109			109			109			112			112			112		
R ² / R ² adjusted	0.220 / 0.175			0.468 / 0.383			0.480 / 0.390			0.075 / 0.022			0.262 / 0.147			0.271 / 0.149		
Deviance	4.724			3.222			3.148			6796.163			5419.962			5354.674		

Note. TCMP (2013) composite score serves as the outcome for Regressions 1 through 3. TCMP “don’t know” score serves as the outcome for Regressions 4 through 6.

the persons of color indicator variable for ethnicity ($b_3 = -1.002, p = .560$), year level ($b_4 = 2.333, p = .100$), and first-generation student status ($b_5 = -2.355, p = .187$) were not significant covariates. Controlling for these covariates, the treatment prime condition ($b_6 = -0.795, p = .607$) was not a statistically significant predictor of endorsement of the “don’t know” response. Those in the treatment condition, who received metacognitive- and critical-thinking-based words, did not demonstrate a different level of endorsement of the “don’t know” response than those in the control condition, who received neutral words. Also, only 7.51% of the variation in the endorsement of the “don’t know” response was explained by this set of predictors.

The fifth regression model, which addressed RQ2, was:

$$\text{predicted TCMP “don’t know” score} = b_0 + b_1(\text{gender}) + b_2(\text{age}) + b_3(\text{ethnicity}) + b_4(\text{year level}) \\ + b_5(\text{college-generation status}) + b_{6-15}(\text{personality traits}).$$

This combination of predictors significantly predicted endorsement of the potentially-metacognitively-advanced response of “don’t know” on the psychological misconceptions test, $F(15, 96) = 2.277, p = .008$. Although gender ($b_1 = -2.558, p = .164$), age ($b_2 = -1.290, p = .092$), ethnicity ($b_3 = -1.337, p = .421$), and college-generation status ($b_5 = -0.810, p = .634$) were not significant covariates, year level ($b_4 = 3.059, p = .032$) was a statistically significant, positive covariate. As students’ year level of college when they took an introductory psychology course increased, their frequency of endorsement of the “don’t know” response on the psychological misconceptions test also increased. Controlling for these covariates, the combined set of personality traits statistically significantly predicted endorsement of the “don’t know” response, $F(10, 96) = 2.468, p = .011$. Considered individually, only orderliness, one of the traits representing conscientiousness ($b_{11} = -3.301, p = .037$), statistically significantly predicted

endorsement of the “don’t know” response. As orderliness decreased, the frequency of endorsement of the “don’t know” response on the psychological misconceptions test increased. The other personality traits (withdrawal: $b_6 = -1.270$, $p = .543$; volatility: $b_7 = 1.443$, $p = .272$; compassion: $b_8 = 2.888$, $p = .157$; politeness: $b_9 = 4.090$, $p = .060$; industriousness: $b_{10} = 1.308$; $p = .487$; enthusiasm: $b_{12} = 0.754$, $p = .672$; assertiveness: $b_{13} = 0.078$, $p = .968$; intellect: $b_{14} = 0.632$, $p = .710$; openness: $b_{15} = -0.443$; $p = .780$) were not significant predictors. However, 26.24% of the variation in the endorsement of the “don’t know” response on the psychological misconceptions test was explained by this set of predictors.

In this model, predictors with relative importance are those with a Pratt Index greater than 0.033. With a Pratt Index of 0.097 for year level and 0.083 for orderliness, these predictors were not only statistically significant but also relatively important compared to the other predictors.

The sixth and final regression model, which addressed RQ1 again, was:

$$\begin{aligned} \text{predicted TCMP “don’t know” score} = & b_0 + b_1(\text{gender}) + b_2(\text{age}) + b_3(\text{ethnicity}) + b_4(\text{year level}) \\ & + b_5(\text{college-generation status}) + b_{6-15}(\text{personality traits}) \\ & + b_{16}(\text{prime condition}). \end{aligned}$$

This combination of predictors significantly predicted endorsement of the “don’t know” response on the psychological misconceptions test, $F(16, 95) = 2.21$, $p = .009$. Again, gender ($b_1 = -2.500$, $p = .173$), age ($b_2 = -1.340$, $p = .081$), ethnicity ($b_3 = -1.341$, $p = .420$), and college-generation status ($b_5 = -1.005$, $p = .557$) were not significant covariates, but year level of college ($b_4 = 2.984$, $p = .036$) was a statistically significant, positive covariate, with the frequency that the “don’t know” response was endorsed on the psychological misconceptions test increasing as

students' year level of college increased. Also, orderliness ($b_{11} = -3.682, p = .024$) once again significantly predicted endorsement of the “don't know” response on the psychological misconceptions test. As was the case before, as orderliness decreased, the frequency of endorsement of the “don't know” response increased. The other personality trait predictors, again, did not significantly predict endorsement of the “don't know” response (withdrawal: $b_6 = -1.366, p = .513$; volatility: $b_7 = 1.665, p = .210$; compassion: $b_8 = 2.779, p = .173$; politeness: $b_9 = 4.115, p = .058$; industriousness: $b_{10} = 1.265, p = .501$; enthusiasm: $b_{12} = 0.862, p = .629$; assertiveness: $b_{13} = 0.111, p = .955$; intellect: $b_{14} = 0.838, p = .624$; openness: $b_{15} = -0.361, p = .820$). Controlling for these covariates, the treatment prime condition ($b_{16} = -1.645, p = .285$) was not a statistically significant predictor of endorsement of the “don't know” response on the psychological misconceptions test. Those who received metacognitive- and critical-thinking-based words did not demonstrate a different level of endorsement of the “don't know” response than those who received neutral words. However, 27.13% of the variation in the endorsement of the “don't know” response on the psychological misconceptions test was explained by this complete set of predictors.

In this model, predictors with relative importance are those with a Pratt Index greater than 0.031. With a Pratt Index of 0.092 for year level and 0.089 for orderliness, these predictors were statistically significant and relatively important compared to the other predictors.

Independent-Samples *t*-Test: Prime Condition Differences on TCMP (2013) Difference Score

An independent-samples *t*-test showed no statistically significant difference between the treatment and control conditions on the TCMP (2013) difference score, $t(107) = 1.452, p = .150$.

Hence, those in the treatment group, who received the metacognitive- and critical-thinking-based words, did not differ from those in the control group, who received neutral words, in the type of error (i.e., rejecting the true items or accepting the false items) that they made on the psychological misconceptions test.

Multilevel Models: TCMP (2013) Qualifier Differences

Participant ID served as the cluster variable in these analyses. All 117 participants were included in these analyses with a total of 5351 complete observations across these clusters, after removing responses in which participants selected “don’t know,” which were treated as missing. All participants were included because multilevel growth modeling for the study of individual change can handle missing data at level one while incorporating all participants who were observed at least once (Raudenbush & Bryk, 2002).

Two level-1 predictors were analyzed with these models. The categorical, ordinal-level “time” predictor, grand-mean-centered, represented the 55 repeated measurements for the TCMP (2013) items. The categorical, nominal-level item-qualifier-type predictor delineated between TCMP items that included no qualifiers versus non-universal qualifiers versus universal qualifiers. Finally, the ordinal-level outcome is participants’ endorsement of psychological misconceptions as measured by the TCMP.

A null (i.e., intercept-only) model:

$$\text{Level 1: } \eta_{ijk} = \pi_{0jk}$$

$$\text{Level 2: } \pi_{0jk} = \beta_{00k} + r_{0jk},$$

first was fitted, where η_{ijk} is the predicted cumulative log-odds of the i th item psychological misconception endorsement for participant j with k (one to four) comparisons, and r_{0jk} is the error or variability associated with participant j as they deviate from the overall mean. The level-2 variance (i.e., random effect), $\tau_{00} = 0.076$, was statistically significant ($p < .001$), suggesting that there is significant variability among participants in their item-level psychological misconception endorsement. The moderate intraclass correlation coefficient (0.023) and design effect (2.014) suggest there is a substantial clustering effect, demonstrating the importance of using multilevel models to analyze the TCMP (2013) item-qualifier differences.

Two level-1 predictor models were fit. The first model,

$$\text{Level 1: } \eta_{ijk} = \pi_{0jk} + \pi_{1j}a_{ij}$$

$$\text{Level 2: } \pi_{0jk} = \beta_{00k} + r_{0jk}$$

$$\pi_{1j} = \beta_{10},$$

where η_{ijk} is as defined previously, and a_{ij} (time) is the grand-mean-centered indicator of the i th time point of measurement for participant j . The change in item-level psychological misconception endorsement across time was not statistically significant ($p = .192$), and this effect was not retained in subsequent models.

The second level-1 predictor model,

$$\text{Level 1: } \eta_{ijk} = \pi_{0jk} + \pi_{1j}a_{1ij} + \pi_{2j}a_{2ij}$$

$$\text{Level 2: } \pi_{0jk} = \beta_{00k} + r_{0jk}$$

$$\pi_{1j} = \beta_{10}$$

$$\pi_{2j} = \beta_{20},$$

where η_{ijk} is as defined previously, a_{1ij} is the binary indicator of non-universal qualifiers, and a_{2ij} is the binary indicator of universal qualifiers. Results showed that the fixed effect of item qualifier type was statistically significant. Compared to items with no qualifiers, while items with universal qualifiers did not differ in terms of endorsement of psychological misconceptions ($\beta_{20} = -0.106, p = .134$), items with non-universal qualifiers elicited higher endorsement of psychological misconceptions ($\beta_{10} = 0.249, p < .001$). Releveling the qualifier indicator variable, results showed that items with universal qualifiers elicited lower endorsement of psychological misconceptions in comparison to items with non-universal qualifiers ($\beta_{20} = -0.355, p < .001$).

CHAPTER 5

DISCUSSION

In this study, undergraduate introductory psychology students' metacognitive and critical thinking skills were supraliminally, semantically primed and then these students' abilities to dispel common psychological myths and misconceptions were measured via their endorsement on a psychological misconceptions test. Students' personality traits and demographics were also considered. This study found that persons of color exemplified greater endorsement of psychological misconceptions than their White / Caucasian peers. In terms of personality, compassion negatively predicted, orderliness positively predicted, and intellect negatively predicted endorsement of psychological misconceptions. However, controlling for these covariates, those in the treatment condition, who received metacognitive- and critical-thinking-based words did not demonstrate a different level of endorsement of psychological misconceptions than those in the control condition, who received neutral words. Additionally, in terms of the potentially-metacognitively-advanced response that participants could make on the psychological misconceptions test, this study found that as students' year level of college when they took an introductory psychology course increased, their frequency of endorsement of the "don't know" response on the psychological misconceptions test also increased. Further, the personality trait of orderliness negatively predicted the frequency of endorsement of the "don't know" response. However, controlling for these covariates, those in the treatment condition did

not differ from those in the control in terms of their frequency of endorsement of the potentially metacognitively-advanced response on the misconceptions test.

Therefore, the first hypothesis was not supported: the supraliminal, semantic priming of undergraduate introductory psychology students' metacognitive and critical thinking skills did not positively predict their ability to dispel common psychological myths and misconceptions. This finding likely indicates that this priming manipulation has no effect. However, whether this priming manipulation would have no effect in the general population or only in the sample analyzed in this study remains unclear as it was evident that many of the individuals in the participant pool were less than motivated to put much, if any, effort into completing this study. Moreover, it was assumed that if these students' metacognitive and critical thinking skills could be supraliminally primed, then those who are typically overwhelmed by cognitively-demanding information processing strategies (e.g., metacognition and critical thinking) would not have the chance to consciously rebel against using such skills. However, this relies on the students still possessing these skills, just being unwilling to put in the effort to use them, which may not have been a valid assumption. Considerable practice, feedback, and reflection are required for students to use reasoning when interpreting psychological claims (Mueller et al., 2020). Also, although this finding was surprising from the standpoint that Swami et al. (2014) found that priming analytic thinking skills led to less endorsement of conspiracy theories, conspiracy theories and psychological misconceptions may very well be more distinct than initially thought, especially as the popular psychology industry is invested in maintaining endorsement in these misconceptions. Further, different words were used in the treatment priming tasks in this study versus the study conducted by Swami et al., which may have also resulted in the differing findings between the two studies.

On the other hand, this study's second hypothesis was partially supported: some personality traits do predict undergraduate introductory psychology students' ability to dispel common psychological myths and misconceptions. Specifically, compassion (an aspect of agreeableness), orderliness (an aspect of conscientiousness), and intellect (an aspect of openness/intellect) were all predictive of endorsement of psychological misconceptions, while only orderliness was predictive of endorsement of the "don't know" response on the psychological misconceptions test. These findings partially support Swami et al.'s (2016) findings that individual differences in personality predict level of belief in science-related myths, while this present study also provides a more nuanced interpretation of which aspects of the Big Five personality traits may actually be responsible for misconception endorsement. However, the specific directions of some of these personality effects were surprising. Although it is of no surprise that as intellect decreases, endorsement of psychological misconceptions increases, it is surprising that as compassion decreases or orderliness increases, endorsement of psychological misconceptions increases. It would seem that, as individuals' compassion (and general agreeableness) increases, they may be more inclined to take the perspective of those around them and potentially endorse more misconceptions if those individuals largely endorse misconceptions. However, if compassion decreases, as the results suggest, individuals may not care to have much of an opinion on their own, potentially making them more inclined to accept the popular psychology industry's promotion of misconceptions. On the other hand, it may be expected that as orderliness (and general conscientiousness) decreased, misconception endorsement would increase. These unexpected findings may, again, result from participants' low effort as they completed the personality instrument.

Additionally, despite Gardner and Brown (2013) and DeYoung et al. (2007) finding

reliability evidence for their instruments, with reliability indices exceeding the .80 criterion, for the TCMP and BFAS, respectively, equivalent reliability evidence was not found in this study. This may be another explanation for why the hypotheses were either only partially supported or not supported at all. However, the low reliability evidence found in this study for these instruments may very well be due in large part to the overall lack of effort that many participants appeared to put into their completion of this study's tasks. The fact that some items were found to be negatively correlated with the total scale after reverse scoring had taken place for items that clearly should have been reverse-scored (i.e., true items on the TCMP and statements in opposition to the personality trait in question on the BFAS) suggests that participants may have been response-setting to some extent rather than carefully reading and responding to each item on these instruments. Therefore, at this point, it cannot be confidently concluded that the TCMP and BFAS produce unreliable measurements of psychological misconception endorsement and personality, respectively.

Implications

Implications for Research

Students in general-education courses, such as introductory psychology, often only exert a limited amount of cognitive effort in such courses, especially if they do not intend on majoring in that field (Cavazos et al., 2021). Hence, the effort these students exert when completing their research participation credits, if they choose to complete them at all, is likely even more limited among many students. This lack of effort from the student participants was clearly evident in this

study, as many more participants than anticipated had to be excluded due to their low effort, and the level of effort of those retained in the analytic data set was still highly questionable. With such little effort from the participants, trying to prime or even explicitly request that they employ their metacognitive and critical thinking skills on a particular study's tasks that are inconsequential to them and their grade is likely futile. As such, the research participation practices that many colleges and universities employ are antiquated and need to be modified.

Additionally, the psychological misconceptions literature typically employs two types of research methodologies: those in which data collection occurs in a lab or those in which data are collected in a particular faculty member or instructor's classroom. Considering the latter, there is increased ecological validity and students may exert more effort on interventions and instructional techniques employed in their classrooms compared to those tested in a lab, but there is a lack of experimental control. "Person effects" also become more concerning when the researcher is simultaneously the students' instructor. Hence, more scientifically-sound research methodologies and practices need to be designed and employed before we will likely be able to confidently conclude which instructional techniques and interventions will facilitate students to dispel psychological myths and misconceptions to the greatest extent possible in both immediate and long-term contexts.

Implications for Practice

Similar to Gardner and Brown (2013), I found that, on average, introductory psychology students thought that both psychological facts and misconceptions on the TCMP (2013) were partly false and partly true, exemplified by a mean score of 2.92 across both the treatment and

control groups in this study. Hence, in this study, students, on average, appeared to endorse both psychological facts and misconceptions to an equivalent degree. Consequently, psychological misconceptions are not only prevalent, but also often resistant to correction, making them ever more difficult to dispel and correct but crucial for introductory psychology instructors to be aware of (Sibicky et al., 2021) and debunk. Also, this study found that endorsement of psychological myths and misconceptions was more prevalent among persons of color than Whites / Caucasians. Hence, introductory psychology instructors need to be aware of any sociocultural differences that may be at play when trying to correct their students' inaccurate beliefs in particular psychological myths and misconceptions.

Finally, this study found that endorsement of the “don't know” response on a psychological misconceptions test was more evident as the year level of college in which students take an introductory psychology course increases. This may indicate that students who have completed more of their college career exert less effort when completing their psychology participation credits. Having already selected a program of study, an introductory psychology course is merely a general-education requirement. In contrast, this may also suggest that as students complete more of their college career by the time they take an introductory psychology course, they may have more of the metacognitive and critical thinking skills required to realize that they do not know the information necessary to judge the truth or falsity of particular psychological claims and select the potentially metacognitively-advanced response of “don't know.” Having completed more of their college career, these students also likely have had more life experience from their time at college to counter their experiences that had until now come almost exclusively from their communities and families. This may encourage students to be more open to new ideas, including acknowledging when they do not know a particular fact.

Consequently, different instructional techniques to dispel students' endorsements in psychological myths and misconceptions may be differentially effective depending on students' year level of college.

Study Limitations

One limitation of the present study could be the use of a post-test only experimental design, rather than the pre-test post-test or Solomon four-group designs. Using a post-test only design means that both the treatment and control groups may not have had equivalent scores on the TCMP (2013) prior to the priming manipulation. This limitation of equivalence, however, should have been minimized with the use of a moderately large sample size and random assignment. On the other hand, if the pre-test post-test design was used, the pre-test measure would have had to be given to participants several weeks before the priming task with the post-test given to participants immediately after the priming task (as has been done in the prior literature, e.g., Swami et al., 2014). Nevertheless, giving participants a pre-test of the TCMP or a similar measure (before participants were exposed to either the treatment or control priming manipulation) could have primed and cued participants in on what they were about to experience and the purpose of the study. Because these participants would think that they knew the study's purpose, they may have purposely responded differently to the items on the post-test, regardless of their level of misconception endorsement. Conversely, participants may not have put in as much effort and may have tried to recall their pre-test rating selection for the post-test administration of the TCMP once they realized that the post-test appeared to have been the exact same or similar test as the pre-test. Although analyses on data collected using the Solomon four-

group design could have determined whether there was an effect of the pre-test on the dependent variable, both the pre-test post-test and Solomon four-group designs would have been too stringent in terms of the realities of using students' time and the university's research participation practices which grant credit to participants for each portion of a multi-part study. Students randomly assigned to the conditions that received both the pre- and post-tests would have had to come back several weeks later to the research management system to complete the majority of the study's tasks (i.e., priming task, post-test, personality test, demographic items, and funneled debriefing procedure). The on-going coronavirus (i.e., COVID-19) pandemic impacted participant recruitment as much fewer students sought to participate in studies this academic year than in prior years, and many of those who did fulfill their research participation requirements exerted low effort as they completed the studies. Hence, there would have likely been a high attrition rate, with many students choosing to complete the first, very short portion of the study and, after receiving the credit associated with that portion, not returning to complete the second, much longer portion of the study for the remainder of the credit. Thus, upon having considered the potential limitations with each of the experimental designs, the post-test only design was used because it had the most manageable limitations.

The participants' lack of effort while they completed the present study's experimental tasks (e.g., scrambled sentence priming task, TCMP (2013), BFAS (2007)) was another substantial limitation because these tasks were of no consequence to the students or their grades. This limitation would have ideally been minimized by instructors encouraging their students to participate in research studies by offering students course credit for their participation. However, students received course credit regardless of whether they participated in the study; merely signing up for the study was enough to receive credit, which many students exploited.

Administering the study's tasks during participants' regular class sessions in their physical classrooms may have led students to be cognitively predisposed to put in more effort on tasks delivered in that specific time and place. However, many of the introductory psychology courses were online, and as education is increasingly switching to online platforms, an online-administered study to be completed at the students' convenience should have still elicited as much of an effortful response from students as an in-person administered study would have, as long as it was school-affiliated and endorsed by the students' instructors. Nevertheless, that did not seem to be the case for this study.

The fall semester participants having been previously taught the concept of "priming" in their introductory psychology courses prior to participating in this study may be a limitation. There is a chance that at least some participants may have recognized the fact that the scrambled sentence task was attempting to prime them. However, it is unlikely that participants having learned about priming in their introductory psychology courses would have influenced and changed their responses on the experimental tasks as this would likely require a high road transfer. Participants would first have to recognize that a priming task has been presented to them, making a connection between their present experience and a concept they learned in class to think about and focus on the priming. It was highly unlikely that participants invested that much cognitive energy as they participated in a research study with little consequence to them or their grade. There was also approximately a month or more time in between the participants having been taught priming and the beginning of data collection for this present study. In addition, many students take a psychology course in high school, where they may have been taught priming as well. However, introductory psychology courses often teach priming in a general sense, if at all, and do not explicitly teach the ways in which priming is actually

conducted in research (e.g., a scrambled sentence task). Also, completing data collection in the few weeks from when the introductory psychology courses began to when priming was taught was not realistic. There were likely not enough students seeking to participate in studies at that point in the semester. Finally, the funneled debriefing procedure determined how many participants were aware that the scrambled sentence task was designed to prime them and of the relationship between the priming manipulation and the subsequent experimental tasks.

Similarly, another limitation could be the communication between participants that may have been likely due to participants coming from the same class sections and year. Due to this communication, initial participants' awareness of the true purpose of this study could influence later participants' awareness and behaviors. However, this limitation was minimized by delaying the full debriefing until the time period for participation had ended.

Additionally, the length of the scrambled sentence priming task could have been a limitation. Although the task is within the range of typical scrambled sentence priming tasks used by previous researchers (e.g., Bargh & Chartrand, 2000), there is no set number of sentences to include or neutral words to incorporate within the treatment prime in comparison to treatment words. Beyond the length of the priming manipulation, the use of Bradley and Lang's (1999) *ANEW* to select semantically and emotionally neutral words for the priming manipulation may have been another limitation. Although the words in both the treatment and control condition are equivalent with respect to their semantic and emotional neutrality, there may be better words to use for particularly the treatment condition to elicit metacognitive and critical-thinking skills. Because construct validity evidence has the potential to demonstrate whether a construct is measured as it is intended by a test (Frey, 2018), this limitation could be minimized by examining construct-related validity evidence for the prime words selected for the treatment

condition. This would then solidify whether the selected treatment prime words are in fact promoting metacognitive and critical-thinking skills, as intended, or no cognitive skills in particular like the control prime words. This may provide one possibility for why the priming manipulation did not predict students' ability to dispel psychological misconceptions. However, additional construct-related validity evidence was not examined here because the focus of this study was not a psychometric assessment of the priming task.

Furthermore, the use of the TCMP (2013) could be a limitation of the present study because there has been limited reliability and validity evidence established for this misconceptions test in the literature. Although the TCMP was constructed with methodological considerations that previous scales ignored (e.g., Gardner & Dalsing, 1986; Vaughan, 1977), there are still a couple concerns with Gardner and Brown's (2013) construction of their misconceptions test. Gardner and Brown only used five statements to measure the misconceptions in each subfield of psychology, and their test is based on Lilienfeld et al.'s (2010b) book which was not intended to be a comprehensive examination of the psychological myths and misconceptions of each subfield. This limitation was minimized by further examining the psychometrics, such as the reliability evidence, of the TCMP for the present study's sample. Low reliability evidence for the TCMP was established in this study, some of which, however, may be due to participants' low effort when completing the TCMP. Nevertheless, additional reliability and validity evidence is needed for the TCMP, and if this evidence cannot be established, then the TCMP should either be modified or another misconceptions test appropriate for introductory psychology students should be found or devised in future research examining psychological misconception endorsement.

The construction of the TCMP (2013) may also be concerning from an assessment

perspective. Non-universal qualifiers such as “most” and “some” may cue participants that these statements are true, while universal qualifiers such as “only” and “all” may cue participants that these statements are false. This is despite the fact that the statements may be either true or false, regardless of the cue. Therefore, participants may try to determine if the statements are true or false, not based on their current awareness of psychological myth and fact, but rather on their test-taking skills that elicit such strategies as using word choice to determine the truth or falsity of the statements. Findings from this study suggest this as the case: items with non-universal qualifiers elicited higher endorsement of psychological misconceptions than items with no qualifiers, and items with universal qualifiers elicited lower endorsement of misconceptions than items with non-universal qualifiers. However, this limitation was minimized with the research design that controlled for these wording effects because all participants received the same misconceptions test with the same qualifiers embedded in each item.

The inclusion of the “don’t know” response option on the TCMP (2013) could be a further limitation to using this misconceptions test. Participants may be easily inclined to select the “don’t know” option if they do not want to think about the items or if they want to quickly complete the experimental tasks. If this happens to be the case, then there would be a lot of missing data. This missing data may also not be missing completely at random, which was found to be the case in this study, for one of two possible reasons: (1) those who do not know may also be more likely to be those who incorrectly endorse the myths or reject the true statements, or (2) in some cases, selecting “don’t know” may be the metacognitively-advanced response, such that the participants realize that they do not have the knowledge needed to make judgments about the truth or falsity of particular statements. However, if the “don’t know” option was not provided, then participants would be forced to decide whether the statement is true or false, regardless of

the fact that they may truly not know. Forcing such a “false positive” or “false negative” would introduce additional bias into the measurement of psychological misconception endorsement. Also, even without a “don’t know” option, participants could still choose to “opt out” of responding by response-setting any of the answer choices, which would probably be the case then with the middle-of-the road response (“partly false and partly true”). There are also other benefits to including a “don’t know” option. For instance, Gardner and Dalsing (1986) report that the “don’t know/no opinion” option, while being two entirely different perspectives that a participant could have, decreases the indicated level of misconceptions, providing what is probably a more accurate reflection of the true level of misconceptions endorsed for each item. Providing no option other than “true” or “false” not only truncates options, but also inflates the level of misconception endorsement by forcing participants to have an opinion on each item, even when the participant has no knowledge or opinion related to the item in question (Gardner & Dalsing, 1986). Additionally, participants’ use of the “don’t know” option has not been excessive in the past. On a different psychology misconceptions test that contained 60 false statements about psychology and that participants had the option to select “true,” “false,” or “don’t know/no opinion,” Gardner and Dalsing found that participants selected the “don’t know/no opinion” option a mean of 12.18% of the time. On a previous administration of the TCMP, participants responded with the “don’t know” option 13.1% of the time (Gardner & Brown, 2013). In this study, participants selected the “don’t know” option on the TCMP a mean of 16.84% of the time.

The use of the BFAS (2007) could be a limitation of the present study as well. It is possible that a different personality measure would capture the traits more predictive of the ability to dispel psychological myths and misconceptions, because the BFAS is rooted in factors

specific to the Big Five personality model. However, the Big Five is a widely used and promising model of personality that still captured some personality differences among participants and predicted endorsement of psychological myths and misconceptions. Also, in terms of psychometrics, evidence of the BFAS's reliability and validity has been examined in multiple domains. Although the BFAS could be psychometrically improved upon by developing and including additional items targeting the 10 personality traits measured, the BFAS was intended to be a shorter instrument than other, more time-consuming personality instruments.

Finally, there were some limitations to this present study due to data collection having been conducted online. For instance, participants completed the experimental tasks in an environment that was not researcher-controlled. Hence, there may have been distractions present in the participants' environments as they completed the experimental tasks online, which may have decreased their priming and use of their metacognitive and critical-thinking skills. Additionally, some participants may not have completed all of the experimental tasks in one sitting. Consequently, there may have been a longer delay than anticipated between completing the priming task and the psychological misconceptions test, which would have reduced the effectiveness of the priming manipulation. If future studies use Qualtrics to conduct a similar study electronically without participants completing the study in a controlled, laboratory setting, then the default setting in Qualtrics that allows participants one week to complete the study (once the link has been clicked on by that participant) should be changed so that participants only have approximately an hour to complete the experimental tasks. However, it would have to be clearly stated to participants through the research management system (e.g., SONA) that they only have an hour to complete the tasks, and there would still be the risk that some participants would click on the link before reading that message and not complete the tasks within an hour's time, causing

the researcher to lose those individuals as participants.

Recommendations for Future Research and Conclusion

For students' endorsements in psychological misconceptions to decrease, students must engage in the conceptual changes required to correct their previously-endorsed misconceptions (Cavazos et al., 2021). Student interest may be one key element in dispelling psychological misconceptions (Cavazos et al., 2021), but introductory psychology instructors need students to be willing to engage in this conceptual change regardless of their level of interest. Therefore, future research should continue to examine variables that predict endorsement of psychological misconceptions and examine factors that promote students to engage in the conceptual change required for common psychological myths and misconceptions to be dispelled.

Additionally, future research should examine the relationship between ethnicity and psychological misconception endorsement in greater detail. In this study, it was found that individuals from minority ethnic groups endorse psychological misconceptions to a greater extent than their White / Caucasian peers. However, up to this point, little if any research has studied this relationship, and, because individuals from all minority ethnic groups were aggregated into a single group in this study, it remains unclear whether individuals from some minority ethnic groups endorse psychological misconceptions to a greater extent than individuals from other minority ethnic groups.

Nevertheless, it is evident that a majority of undergraduate introductory psychology students endorse and believe in many common psychological myths and misconceptions. Endorsement of these psychological myths and misconceptions was more evident among persons

of color than their White / Caucasian peers. Furthermore, endorsement of the “don’t know” response on the psychological misconceptions test was more evident as the year level of college in which students took the introductory psychology course increased. Although priming metacognition and critical thinking may not be the solution for promoting undergraduate introductory psychology students to dispel psychological myths and misconceptions, this is still a growing area of research. A deeper understanding of what may be the underlying causes of this endorsement of misconceptions on an individual level (rather than a societal level) as well as more effective and efficient instructional techniques and interventions are needed to better facilitate undergraduate psychology education.

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APPENDIX A
PRIMING MANIPULATION

Order of Prime Words

Treatment Prime

(metacognitive and critical thinking words)

Concentrate

Window

Detail

Egg

Serious

Absurd

Errand

Humble

Nonsense

Cabinet

Method

Kettle

Context

Milk

Theory

Sentiment

Corner

Skeptical

Control Prime

(neutral words)

Board

Window

Book

Egg

Building

Chair

Errand

Door

Item

Cabinet

Jelly

Kettle

Paper

Milk

Plain

Street

Corner

Table

Priming Scrambled Sentence Task – Treatment

Language Skills Task

Instructions: For each set of words below, make a coherent and grammatical **four word sentence** and type it in the space provided. Do **not** change the tense or part of speech of any of the provided words.

Examples: (1) woke he alert coffee up = He woke up alert
 (2) bench the walked on sit = Sit on the bench

Treatment Prime**Sample Answers**

him *concentrate* tried to she

She tried to concentrate.

window sunny the cleaning needed

The window needed cleaning.

writer *detail* bought the added

The writer added detail.

your devour scrambled him egg

Devour your scrambled egg.

serious the dropped instructor was

The instructor was serious.

found *absurd* read we that

We found that absurd.

ran we stop errand an

We ran an errand.

intellectually cared were *humble* they

They were intellectually humble.

the ignored *nonsense* they played

They ignored the nonsense.

recline was cabinet the built

The cabinet was built.

method them analyzed the he

He analyzed the method.

kettle she tea whistled the

The tea kettle whistled.

story's consider observe *context* the

Consider the story's context.

friends ate milk the guzzled

The friends guzzled milk.

toss accurate an devise *theory*

Devise an accurate theory.

his reject was *sentiment* supported

His sentiment was supported.

corner dim was the had

The corner was dim.

deeply was tossed she *skeptical*

She was deeply skeptical.

Note: Italicized words are the critical priming words for metacognition and critical thinking. They will not be italicized in the actual task given to participants. Sample answers will not be given to participants.

Priming Scrambled Sentence Task – Control

Language Skills Task

Instructions: For each set of words below, make a coherent and grammatical **four word sentence** and type it in the space provided. Do **not** change the tense or part of speech of any of the provided words.

Examples: (1) woke he alert coffee up = He woke up alert
 (2) bench the walked on sit = Sit on the bench

Control Prime**Sample Answers**

writing had board the scent

The board had writing.

window sunny the cleaning needed

The window needed cleaning.

open laid book the song

The book laid open.

your devour scrambled him egg

Devour your scrambled egg.

stubborn building the crowded was

The building was crowded.

chair sat your in push

Push in your chair.

ran we stop errand an

We ran an errand.

the keep open cautious door

Keep the door open.

item now returned the was

The item was returned.

recline was cabinet the built

The cabinet was built.

jelly tasted spread the carefully

Spread the jelly carefully.

kettle she tea whistled the

The tea kettle whistled.

wrinkled paper the written he

He wrinkled the paper.

friends ate milk the guzzled

The friends guzzled milk.

clothes her wash plain looked

Her clothes looked plain.

street they meet the crossed

They crossed the street.

corner dim was the had

The corner was dim.

dinner the needs table set

Set the dinner table.

Note: Sample answers will not be given to participants.

APPENDIX B

PSYCHOLOGICAL MISCONCEPTIONS TEST

Gardner and Brown's (2013) *Test of Contemporary Misconceptions in Psychology* (TCMP)

Please answer the questions below using the following ratings: 1 – completely false, 2 – mostly false, 3 – partly false and partly true, 4 – mostly true, 5 – completely true, 6 – don't know.

Brain and behavior

1. Most people use only about 10% of their brain power.
2. Visual perceptions are accompanied by tiny emissions from the eyes.
3. Adult humans can grow new brain cells. *
4. Almost all color-blind people can see at least some colors. *
5. Some people are exclusively left-brained while others are right-brained.

Development and aging

6. People become increasingly satisfied with their lives in old age. *
7. Most adopted children are psychologically healthy. *
8. Married couples enjoy more marital satisfaction after they have children.
9. Infants establish attachment bonds only to their mothers.
10. A small percentage of the elderly live in nursing homes. *

Memory

11. It is not common for individuals to repress the memories of traumatic experiences. *
12. People with amnesia can still recall some details of their earlier lives. *
13. The memory of everything we've experienced is stored permanently in our brains, even if we can't access all of it.
14. With effort, we can remember events back to the time of our birth.
15. Some people have true photographic memories.

Intelligence and learning

16. IQ scores are relatively unstable in childhood. *
17. There is a modest correlation between brain size and IQ in humans. *
18. As a general rule, students typically recall only 10% of what they read.
19. Irregularly provided feedback best promotes long-term learning. *
20. Negative reinforcement is a type of punishment.

Consciousness

21. Hearing material while we are asleep (sleep learning) can be an effective aid to learning.
22. Hypnotized people are aware of their surroundings and can recall the details of conversations overheard during hypnosis. *
23. It is impossible to lie under hypnosis.
24. Virtually all people dream. *
25. Our brains rest during sleep.

Emotion and motivation

- 26. The polygraph (lie detector) test is not an accurate means of detecting dishonesty. *
- 27. Ulcers are caused primarily by stress.
- 28. Women are no better than men at accurately guessing the feelings of others. *
- 29. Unfamiliarity breeds contempt: We dislike things we have less exposure to. *
- 30. Extreme fear can turn our hair white.

Social psychology

- 31. We are most romantically attracted to people who are similar to us. *
- 32. The more people present at an emergency, the greater the chance that someone will intervene.
- 33. Expressing anger directly toward another person or object makes us more aggressive. *
- 34. Groups tend to make less extreme decisions than individuals.
- 35. The best way to change someone's attitude is to give them a large reward to do so.

Personality

- 36. We cannot tell a person's personality by merely looking at their handwriting. *
- 37. Knowing a person's astrological sign predicts their personality traits at better than chance levels.
- 38. Most people who were physically abused as children do not go on to become abusers themselves. *
- 39. Most children survive the divorce of their parents without much, if any, long-term psychological damage. *
- 40. Obese people are more cheerful ("jolly") than thin people.

Mental illness

- 41. Only deeply depressed people commit suicide.
- 42. People with schizophrenia do not have multiple personalities. *
- 43. There has recently been a massive epidemic of childhood autism.
- 44. All clinically depressed people suffer from extreme sadness.
- 45. Most people who experience severe trauma, as in military combat, do not develop posttraumatic stress disorder (PTSD). *

Psychology and law

- 46. The rates of serial killers are no higher among Whites than other racial groups. *
- 47. Homicide is more common than suicide.
- 48. Most rapes are committed by strangers.
- 49. The words "insanity" and "sanity" are purely legal not psychological terms. *
- 50. Most people that plead insanity are not faking mental illness. *

Psychological treatment

51. More experienced therapists are generally no more effective than those with little experience.*
52. Most psychotherapy involves a couch and exploring one's early past.
53. Antidepressants are much more effective than psychotherapy for treating depression.
54. Taking a placebo (i.e. sugar pill) can change brain functioning and chemistry. *
55. Electroconvulsive therapy is rarely administered today.
-

* Indicates true statements which are reverse scored.

APPENDIX C

PERSONALITY TEST

DeYoung, Quilty, and Peterson's (2007) *Big Five Aspects Scale* (BFAS)

Please respond to the statements below using the following ratings: 1 –strongly disagree, 2 – disagree a little, 3 – neither agree nor disagree, 4 – agree a little, 5 –strongly agree.

I...

Neuroticism

Volatility

- Get angry easily.
- Rarely get irritated. *
- Get upset easily.
- Keep my emotions under control. *
- Change my mood a lot.
- Rarely lose my composure. *
- Am a person whose moods go up and down easily.
- Am not easily annoyed. *
- Get easily agitated.
- Can be stirred up easily.

Withdrawal

- Seldom feel blue. *
- Am filled with doubts about things.
- Feel comfortable with myself. *
- Feel threatened easily.
- Rarely feel depressed. *
- Worry about things.
- Am easily discouraged.
- Am not embarrassed easily. *
- Become overwhelmed by events.
- Am afraid of many things.

Agreeableness

Compassion

- Am not interested in other people's problems. *
- Feel others' emotions.
- Inquire about others' well-being.
- Can't be bothered with others' needs. *
- Sympathize with others' feelings.
- Am indifferent to the feelings of others. *
- Take no time for others. *
- Take an interest in other people's lives.
- Don't have a soft side. *
- Like to do things for others.

Politeness

- Respect authority.

Insult people. *
 Hate to seem pushy.
 Believe that I am better than others. *
 Avoid imposing my will on others.
 Rarely put people under pressure.
 Take advantage of others. *
 Seek conflict. *
 Love a good fight. *
 Am out for my own personal gain. *

Conscientiousness

Industriousness

Carry out my plans.
 Waste my time. *
 Find it difficult to get down to work. *
 Mess things up. *
 Finish what I start.
 Don't put my mind on the task at hand. *
 Get things done quickly.
 Always know what I am doing.
 Postpone decisions. *
 Am easily distracted. *

Orderliness

Leave my belongings around. *
 Like order.
 Keep things tidy.
 Follow a schedule.
 Am not bothered by messy people. *
 Want everything to be "just right."
 Am not bothered by disorder. *
 Dislike routine. *
 See that rules are observed.
 Want every detail taken care of.

Extroversion

Enthusiasm

Make friends easily.
 Am hard to get to know. *
 Keep others at a distance. *
 Reveal little about myself. *
 Warm up quickly to others.
 Rarely get caught up in the excitement. *
 Am not a very enthusiastic person. *
 Show my feelings when I'm happy.
 Have a lot of fun.
 Laugh a lot.

Assertiveness

- Take charge.
- Have a strong personality.
- Lack the talent for influencing people. *
- Know how to captivate people.
- Wait for others to lead the way. *
- See myself as a good leader.
- Can talk others into doing things.
- Hold back my opinions. *
- Am the first to act.
- Do not have an assertive personality. *

Openness / Intellect

Intellect

- Am quick to understand things.
- Have difficulty understanding abstract ideas. *
- Can handle a lot of information.
- Like to solve complex problems.
- Avoid philosophical discussions. *
- Avoid difficult reading material. *
- Have a rich vocabulary.
- Thank quickly.
- Learn things slowly. *
- Formulate ideas clearly.

Openness

- Enjoy the beauty of nature.
- Believe in the importance of art.
- Love to reflect on things.
- Get deeply immersed in music.
- Do not like poetry. *
- See beauty in things that others might not notice.
- Need a creative outlet.
- Seldom get lost in thought. *
- Seldom daydream. *
- Seldom notice the emotional aspects of paintings and pictures. *

* Indicates statements which are reverse scored.

DeYoung, Quilty, and Peterson's (2007) *Big Five Aspects Scale* (BFAS)Formatted Version

Here are a number of characteristics that may or may not describe you. For example, do you agree that you seldom feel blue, compared to most other people? Please fill in the number that best indicates the extent to which you agree or disagree with each statement listed below. Be as honest as possible, but rely on your initial feeling and do not think too much about each item.

Use the following scale:

1 - - - - - 2 - - - - - 3 - - - - - 4 - - - - - 5

**Strongly
Disagree**

**Neither Agree
Nor Disagree**

**Strongly
Agree**

- | | |
|--|---|
| 1. ___ Seldom feel blue. | 15. ___ Have difficulty understanding abstract ideas. |
| 2. ___ Am not interested in other people's problems. | 16. ___ Rarely get irritated. |
| 3. ___ Carry out my plans. | 17. ___ Believe that I am better than others. |
| 4. ___ Make friends easily. | 18. ___ Like order. |
| 5. ___ Am quick to understand things. | 19. ___ Have a strong personality. |
| 6. ___ Get angry easily. | 20. ___ Believe in the importance of art. |
| 7. ___ Respect authority. | 21. ___ Feel comfortable with myself. |
| 8. ___ Leave my belongings around. | 22. ___ Inquire about others' well-being. |
| 9. ___ Take charge. | 23. ___ Find it difficult to get down to work. |
| 10. ___ Enjoy the beauty of nature. | 24. ___ Keep others at a distance. |
| 11. ___ Am filled with doubts about things. | 25. ___ Can handle a lot of information. |
| 12. ___ Feel others' emotions. | 26. ___ Get upset easily. |
| 13. ___ Waste my time. | 27. ___ Hate to seem pushy. |
| 14. ___ Am hard to get to know. | 28. ___ Keep things tidy. |

29. ___ Lack the talent for influencing people.
30. ___ Love to reflect on things.
31. ___ Feel threatened easily.
32. ___ Can't be bothered with other's needs.
33. ___ Mess things up.
34. ___ Reveal little about myself.
35. ___ Like to solve complex problems.
36. ___ Keep my emotions under control.
37. ___ Take advantage of others.
38. ___ Follow a schedule.
39. ___ Know how to captivate people.
40. ___ Get deeply immersed in music.
41. ___ Rarely feel depressed.
42. ___ Sympathize with others' feelings.
43. ___ Finish what I start.
44. ___ Warm up quickly to others.
45. ___ Avoid philosophical discussions.
46. ___ Change my mood a lot.
47. ___ Avoid imposing my will on others.
48. ___ Am not bothered by messy people.
49. ___ Wait for others to lead the way.
50. ___ Do not like poetry.
51. ___ Worry about things.
52. ___ Am indifferent to the feelings of others.
53. ___ Don't put my mind on the task at hand.
54. ___ Rarely get caught up in the excitement.
55. ___ Avoid difficult reading material.
56. ___ Rarely lose my composure.
57. ___ Rarely put people under pressure.
58. ___ Want everything to be "just right."
59. ___ See myself as a good leader.
60. ___ Seldom notice the emotional aspects of paintings and pictures.
61. ___ Am easily discouraged.
62. ___ Take no time for others.
63. ___ Get things done quickly.
64. ___ Am not a very enthusiastic person.
65. ___ Have a rich vocabulary.
66. ___ Am a person whose moods go up and down easily.
67. ___ Insult people.
68. ___ Am not bothered by disorder.
69. ___ Can talk others into doing things.
70. ___ Need a creative outlet.
71. ___ Am not embarrassed easily.

72. ___ Take an interest in other people's lives.
73. ___ Always know what I am doing.
74. ___ Show my feelings when I'm happy.
75. ___ Think quickly.
76. ___ Am not easily annoyed.
77. ___ Seek conflict.
78. ___ Dislike routine.
79. ___ Hold back my opinions.
80. ___ Seldom get lost in thought.
81. ___ Become overwhelmed by events.
82. ___ Don't have a soft side.
83. ___ Postpone decisions.
84. ___ Have a lot of fun.
85. ___ Learn things slowly.
86. ___ Get easily agitated.
87. ___ Love a good fight.
88. ___ See that rules are observed.
89. ___ Am the first to act.
90. ___ Seldom daydream.
91. ___ Am afraid of many things.
92. ___ Like to do things for others.
93. ___ Am easily distracted.
94. ___ Laugh a lot.
95. ___ Formulate ideas clearly.
96. ___ Can be stirred up easily.
97. ___ Am out for my own personal gain.
98. ___ Want every detail taken care of.
99. ___ Do not have an assertive personality.
100. ___ See beauty in things that others might not notice.

BFAS (2007) Scoring Key

Neuroticism

Withdrawal: 1R, 11, 21R, 31, 41R, 51, 61, 71R, 81, 91

Volatility: 6, 16R, 26, 36R, 46, 56R, 66, 76R, 86, 96

Agreeableness

Compassion: 2R, 12, 22, 32R, 42, 52R, 62R, 72, 82R, 92

Politeness: 7, 17R, 27, 37R, 47, 57, 67R, 77R, 87R, 97R

Conscientiousness

Industriousness: 3, 13R, 23R, 33R, 43, 53R, 63, 73, 83R, 93R

Orderliness: 8R, 18, 28, 38, 48R, 58, 68R, 78R, 88, 98

Extraversion

Enthusiasm: 4, 14R, 24R, 34R, 44, 54R, 64R, 74, 84, 94

Assertiveness: 9, 19, 29R, 39, 49R, 59, 69, 79R, 89, 99R

Openness/Intellect

Intellect: 5, 15R, 25, 35, 45R, 55R, 65, 75, 85R, 95

Openness: 10, 20, 30, 40, 50R, 60R, 70, 80R, 90R, 100

Reverse response scores for items followed by “R” (i.e. 1=5, 2=4, 4=2, 5=1). To compute scale scores, average completed items within each scale. To compute Big Five scores, average scores for the two aspects within each domain.

APPENDIX D
DEMOGRAPHIC QUESTIONS

Demographic Questions

Please respond to the following prompts to the best of your ability.

1. What is your gender?
 - Male
 - Female
 - Prefer not to answer
 - Prefer to self-describe: _____

2. What is your current age?
 - All ages from under 18 through 99 or older included as response options

3. What is your ethnicity? *Select all that apply.*
 - White / Caucasian
 - Black / African American
 - Hispanic / Latino(a)
 - Asian
 - Middle Eastern
 - Native American
 - Alaska Native
 - Native Hawaiian or Other Pacific Islander
 - Prefer not to answer
 - Other (please specify): _____

4. Please indicate the year level of college you are currently in (please check one):
 - First year
 - Sophomore
 - Junior
 - Senior
 - Fifth year
 - Prefer not to answer
 - Other (please specify): _____

5. Are you a first-generation college student?
 - Yes
 - No
 - Prefer not to answer

6. Did you take a psychology course in high school?
 - Yes
 - No
 - Prefer not to answer

APPENDIX E

INTRODUCTION TO PSYCHOLOGY RECRUITMENT EMAIL

Email sent to Introduction to Psychology Course Coordinator, Dr. Michelle Lilly

Email Subject: Introduction to Psychology Participant Request for Master's Thesis

Dear Dr. Lilly,

I am a graduate student in the Department of Educational Technology, Research and Assessment, with a goal of earning a doctorate degree within the field of psychology. For my master's thesis, I am interested in examining to what extent, if any, does the supraliminal, semantic priming of undergraduate introductory psychology students' metacognitive and critical thinking skills affect their ability to dispel common psychological myths and misconceptions.

Previous research has found that most students enter introductory psychology with a variety of myths and misconceptions, and at the end of the course, these false beliefs continue to be endorsed by students (Taylor & Kowalski, 2004). The belief in and endorsement of psychological misconceptions is often due to the individual's failure or inability to critically think about psychological information that may or may not be accurate (Bensley & Lilienfeld, 2017). It has also been found that participants in an analytic priming condition demonstrated lower belief in conspiracy theories (a subset of false beliefs that many people endorse like psychological myths and misconceptions) than participants in the control condition (Swami et al., 2014). Correcting students' psychological misconceptions by teaching them to think critically is crucial to our society's health and stability (Wilson, 2018).

Therefore, as the coordinator of PSYC 102 Introduction to Psychology, I am writing to you about whether you would be willing to let the fall 2020 introductory psychology students participate in this study (excluding the honors section students). The study will be conducted online via Qualtrics to not require the use of any class time. Ideally, if priming is a topic that is covered in the Introduction to Psychology courses, I would like to be able to conduct this study prior to priming being taught. If possible, I am seeking a sample size ranging from $n = 185$ to $n = 200$ participants. The students would complete a scrambled sentence priming task that will take approximately 10 minutes, and then the students would complete two questionnaires: (1) Gardner and Brown's (2013) *Test of Contemporary Misconceptions in Psychology*, which is a 55-item questionnaire that will take students approximately 10 minutes to complete, and (2) DeYoung, Quilty, and Peterson's (2007) *Big Five Aspects Scale*, which is a 100-item personality questionnaire that will take students approximately 10 minutes to complete. To allow time for the study materials in its entirety, such as the informed consent, demographic questions, and Bargh & Chartrand's (2000) *Funneled Debriefing Procedure for Supraliminal Priming Task*, it is anticipated that this study will take no longer than 45 minutes.

Please let me know if you have any questions as to the nature of this study. If you would like to verify anything with my thesis committee, my chair is Dr. Cynthia Campbell and my committee members are Dr. Thomas Smith and Dr. Bradford Pillow.

I appreciate your taking the time to consider this request, and please let me know as to your willingness to let the Introduction to Psychology students participate in this study.

Thank you.
Sincerely,
Marissa Bamberger

References Cited Above:

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APPENDIX F
INFORMED CONSENT

Language and Psychology

Informed Consent

I agree to participate in the study titled “Language and Psychology” being conducted by Marissa Bamberger, a graduate student at Northern Illinois University.

RESEARCH DESCRIPTION

The purpose of this study is to examine introductory psychology students’ knowledge of language and psychological information. You will first be presented with a scrambled sentence language skills task. After that, you will be asked to complete two questionnaires: (1) a test that contains a list of statements related to the field of psychology and (2) a personality test. You will also be asked to provide some background (e.g., demographic) information about yourself. Your participation is anticipated to take no longer than 45 minutes.

Once data collection has ended for this study, you will be given additional information about the purpose, methods, and expected results of this study.

PARTICIPATION AND WITHDRAWAL

Your participation in this study is completely voluntary. If you wish to not participate in this study at any point, you may choose to do so. Any and all data thus collected from you will not be kept, and you will be removed from the study. Your decision to participate or withdraw from the study will not affect your grades or class standing, your relationship with your professor or the psychology department, or your position at Northern Illinois University.

If you have any additional questions concerning this study, you may contact the primary researcher, Marissa Bamberger at mbamberger1@niu.edu, or the faculty advisor of this research, Dr. Cynthia Campbell at ccampbell@niu.edu. If you wish for further information regarding your rights as a research subject, you may contact The Office of Research Compliance, Integrity, and Safety at Northern Illinois University at (815) 753-8588.

BENEFITS

The benefits of participating in this study include helping the researcher understand the nature of introductory psychology students and the language used in course content and materials. Additionally, by participating, you will learn how research is conducted on this kind of topic.

RISKS AND CONFIDENTIALITY

There are no reasonably foreseeable (or expected) risks and/or discomforts associated with being a participant in this study. All information gathered during this experiment will be anonymous. No personally identifying information will be collected.

Northern Illinois University policy does not provide for compensation for, nor does the University carry insurance to cover injury or illness incurred as a result of participation in University sponsored research projects.

Your consent to participate in this study does not constitute a waiver of any legal rights or redress that you might have as a result of your participation.

I acknowledge that I have read through the entirety of this consent form. The purpose and procedures of this study have been explained to me, and I agree to voluntarily participate. I understand that I am free to withdraw from the study at any time without being penalized. I certify that I am 18 years of age or older.

Please click on the button below to indicate your informed decision regarding participating in this study.

Yes, I agree to participate.

No, I do not agree to participate.

APPENDIX G

FUNNELED DEBRIEFING PROCEDURE

Bargh & Chartrand's (2000) *Funneled Debriefing Procedure for Supraliminal Priming Task*

The experimenter proceeds to ask the participant the following questions, and records the answers given:

1. What do you think the purpose of this experiment was?
 2. What do you think this experiment was trying to study?
 3. Did you think that any of the tasks you did were related in any way?
(if "yes") In what way were they related?
 4. Did anything you did on one task affect what you did on any other task?
(if "yes") How exactly did it affect you?
 5. When you were completing the scrambled sentence test, did you notice anything unusual about the words?
 6. Did you notice any particular pattern or theme to the words that were included in the scrambled sentence test?
 7. What were you trying to do while reading the psychology-related phrases shown after the scrambled sentence test? Did you have any particular goal or strategy?
- (Originally: What were you trying to do while reading the behavioral phrases on the computer monitor? Did you have any particular goal or strategy?)

Sample Answers that are Problematic

1. The purpose of this experiment was to...
 - prime
 - prime critical thinking / metacognition / analysis / cognition / higher-order thinking skills, or the like
 - prime to dispel / reduce endorsement / reduce belief in psychological misconceptions / myths / misinformation
2. This experiment was trying to study...
 - priming
 - the relationship between priming and psychological misconceptions / myths / misinformation (or the influence / effect of priming on the belief in psychological misconceptions / myths / misinformation)
 - the relationship between priming and personality (or the influence / effect of priming on one's reporting of their personality)

3. If yes, the tasks were related in the following way:

- The initial (priming / language skills / scrambled sentence) task was related to the psychology (misconceptions) test that followed it
- The initial (priming / language skills / scrambled sentence) task was related to the personality test that followed it

This is not a concern if the participant responds “No” or “I am not sure.”

4. If yes, one task affected me on another task in the following way:

- The initial (priming / language skills / scrambled sentence) task affected my responses on the psychology (misconceptions) test in some way (such as how I thought about the psychological statements, with how I judged the truth or falsity of the statements)
- The initial (priming / language skills / scrambled sentence) task affected my responses on the personality test in some way (such as how I thought about or rated myself in terms of the personality traits / statements)

This is not a concern if the participant responds “No” or “I am not sure.”

5. Yes, the words were unusual in that a large portion of the words were related to critical thinking / metacognition / analysis / cognition / higher-order thinking skills, or the like.

6. Yes, there was a particular pattern or theme to the words: critical thinking / metacognition / analysis / cognition / higher-order thinking skills, or the like

7. Yes, my particular goal or strategy was to...

- apply some of the words included in the initial (priming / language skills / scrambled sentence) task to how I determined how true or false the psychology-related phrase were
- employ critical thinking / metacognition / analysis / cognition / higher-order thinking skills or the like as I determined how true or false the psychology-related phrases were

Note: If a participant’s answers reflect a genuine awareness of the relationship between the priming manipulation and the subsequent experimental tasks, as in above, then the participant should not be included in the analyses (Bargh & Chartrand, 2000). This includes any answers that were “in the ballpark” for how the priming manipulation could have influenced the participant’s responses (Bargh & Chartrand, 2000). Sample answers will not be given to participants.

APPENDIX H
DEBRIEFING LETTER

Language and Psychology

Debriefing Letter

Dear Participant,

Thank you for your participation in this research study! The purpose of this study was twofold: (1) to determine to what extent, if any, priming undergraduate introductory psychology students' metacognitive and critical thinking skills affects their ability to dispel and not believe in common psychological myths and misconceptions, and (2) to determine to what extent, if any, do undergraduate introductory psychology students' personality traits predict their ability to dispel common psychological myths and misconceptions. **Priming** is the activation of an individual's mental processes by an environmental stimulus and the effect that this activation has on a person's thoughts, attitudes, and behaviors (Bargh & Chartrand, 2000, Chapter 10). **Metacognition** is thinking about thinking, while **critical thinking** is the use of cognitive skills and strategies in a reasoned and goal-directed way (Halpern, 1998). Additionally, **psychological misconceptions** are commonsense, yet false, beliefs about psychological phenomena that seem to be familiar and intuitively true but are inconsistent with research (Bensley & Lilienfeld, 2015).

In this experiment, you were in either the treatment or control condition. If you were in the treatment condition, then you were given a scrambled sentence task that contained words that would have hopefully primed your metacognitive and critical thinking skills before you completed a test of psychological myths and misconceptions. If you were in the control condition, then you were given a list of words that would have hopefully been neutral in terms of priming, not activating any higher-order thinking skills before you completed the test of psychological myths and misconceptions. It was hypothesized that priming undergraduate introductory psychology students' metacognitive and critical thinking skills would improve their ability to dispel common psychological myths and misconceptions. It was also hypothesized that undergraduate introductory psychology students' personality traits would predict their ability to dispel common psychological myths and misconceptions.

If statements in the (1) scrambled sentence task, (2) psychology misconceptions test, or (3) personality test brought up any painful or unpleasant thoughts, and if they continue, you may choose to visit Northern Illinois University's Psychological Services Center located in the Psychology/Computer Science building, room PM86.

REFERENCES

If you are interested in learning more on topics related to this research, see the following articles:

- Bargh, J. A., & Chartrand, T. L. (2000). The mind in the middle: A practical guide to priming and automaticity research. In H. T. Reis & C. M. Judd (Eds.), *Handbook of research methods in social and personality psychology* (pp. 253-285). New York, NY: Cambridge University Press.
- Bensley, D. A., & Lilienfeld, S. O. (2015). What is a psychological misconception? Moving toward an empirical answer. *Teaching of Psychology*, 42(4), 282-292. doi.org/10.1177/0098628315603059

- Gardner, R. M., & Brown, D. L. (2013). A test of contemporary misconceptions in psychology. *Learning and Individual Differences, 24*, 211-215. doi.org/10.1016/j.lindif.2012.12.008
- Halpern, D. F. (1998). Teaching critical thinking for transfer across domains: Dispositions, skills, structure training, and metacognitive monitoring. *American Psychologist, 53*(4), 449-455. Retrieved from <https://www.apa.org/pubs/journals/amp/>
- Swami, V., Voracek, M., Stieger, S., Tran, U. S., & Furnham, A. (2014). Analytic thinking reduces belief in conspiracy theories. *Cognition, 133*(3), 572-585. doi:10.1016/j.cognition.2014.08.006

CONTACT INFORMATION

If you have further questions about the study, please contact Marissa Bamberger at mbamberger1@niu.edu. Thank you!

ANSWERS: *Test of Contemporary Misconceptions in Psychology (Gardner & Brown, 2013)*

F = False, T = True

Brain and behavior

1. Most people use only about 10% of their brain power. – F
2. Visual perceptions are accompanied by tiny emissions from the eyes. – F
3. Adult humans can grow new brain cells. – T
4. Almost all color-blind people can see at least some colors. – T
5. Some people are exclusively left-brained while others are right-brained. – F

Development and aging

6. People become increasingly satisfied with their lives in old age. – T
7. Most adopted children are psychologically healthy. – T
8. Married couples enjoy more marital satisfaction after they have children. – F
9. Infants establish attachment bonds only to their mothers. – F
10. A small percentage of the elderly live in nursing homes. – T

Memory

11. It is not common for individuals to repress the memories of traumatic experiences. – T
12. People with amnesia can still recall some details of their earlier lives. – T
13. The memory of everything we've experienced is stored permanently in our brains, even if we can't access all of it. – F
14. With effort, we can remember events back to the time of our birth. – F
15. Some people have true photographic memories. – F

Intelligence and learning

16. IQ scores are relatively unstable in childhood. – T
17. There is a modest correlation between brain size and IQ in humans. – T
18. As a general rule, students typically recall only 10% of what they read. – F
19. Irregularly provided feedback best promotes long-term learning. – T
20. Negative reinforcement is a type of punishment. – F

Consciousness

- 21. Hearing material while we are asleep (sleep learning) can be an effective aid to learning. – F
- 22. Hypnotized people are aware of their surroundings and can recall the details of conversations overheard during hypnosis. – T
- 23. It is impossible to lie under hypnosis. – F
- 24. Virtually all people dream. – T
- 25. Our brains rest during sleep. – F

Emotion and motivation

- 26. The polygraph (lie detector) test is not an accurate means of detecting dishonesty. – T
- 27. Ulcers are caused primarily by stress. – F
- 28. Women are no better than men at accurately guessing the feelings of others. – T
- 29. Unfamiliarity breeds contempt: We dislike things we have less exposure to. – T
- 30. Extreme fear can turn our hair white. – F

Social psychology

- 31. We are most romantically attracted to people who are similar to us. – T
- 32. The more people present at an emergency, the greater the chance that someone will intervene. – F
- 33. Expressing anger directly toward another person or object makes us more aggressive. – T
- 34. Groups tend to make less extreme decisions than individuals. – F
- 35. The best way to change someone's attitude is to give them a large reward to do so. – F

Personality

- 36. We cannot tell a person's personality by merely looking at their handwriting. – T
- 37. Knowing a person's astrological sign predicts their personality traits at better than chance levels. – F
- 38. Most people who were physically abused as children do not go on to become abusers themselves. – T
- 39. Most children survive the divorce of their parents without much, if any, long-term psychological damage. – T
- 40. Obese people are more cheerful ("jolly") than thin people. – F

Mental illness

- 41. Only deeply depressed people commit suicide. – F
- 42. People with schizophrenia do not have multiple personalities. – T
- 43. There has recently been a massive epidemic of childhood autism. – F
- 44. All clinically depressed people suffer from extreme sadness. – F
- 45. Most people who experience severe trauma, as in military combat, do not develop posttraumatic stress disorder (PTSD). – T

Psychology and law

- 46. The rates of serial killers are no higher among Whites than other racial groups. – T
- 47. Homicide is more common than suicide. – F
- 48. Most rapes are committed by strangers. – F

49. The words “insanity” and “sanity” are purely legal not psychological terms. – T
50. Most people that plead insanity are not faking mental illness. – T

Psychological treatment

51. More experienced therapists are generally no more effective than those with little experience.
– T
52. Most psychotherapy involves a couch and exploring one’s early past. – F
53. Antidepressants are much more effective than psychotherapy for treating depression. – F
54. Taking a placebo (i.e. sugar pill) can change brain functioning and chemistry. – T
55. Electroconvulsive therapy is rarely administered today. – F
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