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Highly Prevalent but Not Always Persistent: Undergraduate and Graduate Student's Misconceptions About Psychology

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Abstract

Although past research has documented the prevalence of misconceptions in introductory psychology classes, few studies have assessed how readily upper-level undergraduate and graduate students endorse erroneous beliefs about the discipline. In Study 1, we administered a 30-item misconception test to an international sample of 670 undergraduate, master's, and doctoral students. Analyses indicated that participants identified and rejected the majority of misconceptions, with doctoral students performing better than their master's or undergraduate peers. In Study 2, we administered a revised version of our questionnaire to a novel sample of 557 students while controlling for number of years spent at university, psychology courses completed, and need for cognition. Once again, we found that graduate students rejected more, affirmed less, and reported lower levels of uncertainty than their undergraduate counterparts. Educational implications and future research directions are discussed.

Keywords

misconceptions, psychology, graduate students, need for cognition

Students new to the study of psychological science often come equipped with preinstructional knowledge and beliefs that are incongruent with the core concepts and empirical findings of the discipline (Kowalski & Taylor, 2009; Thompson & Zamboanga, 2004). Undergraduates frequently endorse a variety of inaccurate claims that lack empirical support, such as *People only use 10% of their brain*, *It's better to express anger than to hold it in* and *Playing Mozart to babies increases their intelligence* (Herculano-Houzel, 2002; Higbee & Clay, 1998; Lilienfeld, Lynn, Ruscio, & Beyerstein, 2009). These misconceptions have been argued to stem from exposure to inaccurate or incomplete information in the popular media (Lewandowsky, Ecker, Seifert, Schwarz & Cook, 2012), instruction and textbooks that present an oversimplification of concepts (Chew, 2006; Stanovich, 2009), and a range of cognitive factors such as confirmatory bias, inferring causation from correlation and post hoc, ergo propter hoc reasoning (see Lilienfeld et al., 2009).

Over the past several decades, three issues have come to dominate the study of psychological misconceptions (for a recent review, see Hughes, Lyddy, & Lambe, 2013). On one hand, the vast majority of work has sought to document how readily the general public (Furnham & Hughes, 2014; Green, Page, Rasekhy, Johnson, & Bernhardt, 2006), students (McCutcheon, 1991; Standing & Huber, 2003), and faculty (Gardner & Hund, 1983) affirm erroneous claims about the discipline. This work has primarily centered on undergraduate (introductory) students who have been found to vary dramatically in the number of misconceptions that they endorse (McCutcheon, 1991; Standing & Huber, 2003). Such large variations from study to study may in part reflect sampling differences (Kuhle, Barber, & Bristol, 2009), the measurement procedures employed (Hughes, Lyddy, & Kaplan, 2013), the amount of disciplinary training students received (Gardner & Dalsing, 1986; Lamal, 1979) as well as their critical thinking ability (Kowalski & Taylor, 2004).

On the other hand, researchers have also attempted to identify key variables and potential strategies for undermining common misconceptions in the classroom. Much of this work has been driven by the assumption that misconceptions negatively

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impact the learning of new information (although this claim currently appears to rest more on theoretical conjecture than empirical evidence; see Hughes, Lyddy, & Lambe, 2013). Generally speaking, these studies have shifted the empirical agenda away from questions concerning the prevalence of misconceptions—and their potential origins—toward the factors necessary for their change, such as refutational teaching strategies (Kowalski & Taylor, 2009) and critical thinking skills (McCutcheon, Apperson, Hanson, & Wynn, 1992). Finally, and in light of the fact that misconceptions are responsive to correction when certain conditions are met, researchers have attempted to articulate why this change occurs. A number of theoretical models have been offered to explain how misconceptions should be conceptualized, why they are resistant to correction, and the conditions necessary for successful learning (Hammer & Elby, 2002; Reif, 1995). Of these models, conceptual change currently represents the dominant theoretical position in the literature (Limón & Mason, 2002). According to this model, revising or restructuring currently held inaccurate beliefs is essential for optimal learning in any given discipline (see diSessa, 2006). When taken together, the above-mentioned work suggests that the tendency to hold inaccurate beliefs about psychology (e.g., ''Carefully controlled research is not necessary for solving psychological problems'') as well as specific disciplinary information (e.g., ''The polygraph test is an accurate detector of lies'') is a prevalent, persistent, and potentially problematic behavior.

The Current Research

Although the above-mentioned work shines a light on the prevalence of misconceptions, as well as the factors responsible for their formation and change, it is nonetheless limited in one key respect: The primary focus has been on undergraduate (introductory) students new to the discipline. Consequently, this analytic strategy is one that remains comparatively silent to the persistence of misconceptions and their adoption by students with many years of training in the core concepts and empirical findings of the field. With this in mind, we set out to expand the misconception literature beyond the borders of the introductory psychology classroom and to determine whether upper-level undergraduate and graduate students also fall prey to erroneous claims. This may be an important issue for the latter group, given that they often serve in a teaching capacity (e.g., lab instructor, teaching assistant, or lecturer) within university and college settings. Those graduate students who subscribe to psychological misconceptions may inadvertently propagate them to the next generation of students and thus represent one potential source of misinformation. Indeed, this assumption appears to be consistent with recent findings suggesting that 38% of students explicitly attribute their misconceptions to what they learned in one of their psychology courses or from their instructor (Landau & Bavaria, 2003; see also Kowalski & Taylor, 2004).

To our knowledge, only two published studies have examined misconception endorsement in advanced members of the discipline. Investigating common misconceptions in college faculty, Gardner and Hund (1983) found that educators who possessed doctoral level training were significantly more likely to recognize and reject misconceptions compared to those with master's level training. Likewise, master's students have been found to hold significantly fewer misconceptions compared to undergraduate students (Arntzen, Lokke, Lokke, & Eilertsen, 2010). However, Gardner and Hund (1983) focused primarily on misconceptions held by faculty and Arntzen, Lokke, Lokke, and Eilertsen (2010) on misconceptions about behavior analysis. In contrast, the current research represents the first attempt to examine general misconceptions about psychology in doctoral, master's, and undergraduate psychology students.

Study 1

Method

Participants

An international sample of 670 psychology students were recruited from a large society focusing on social and personality psychology (466 women and 204 men) and participated in this study on a voluntary basis. Participants ranged in age from 18 to 53 years ($M = 27$, $SD = 5.3$). We only included data for students who were currently working toward the completion of a psychology undergraduate ($n = 49$), master's ($n = 83$), or doctoral level qualification ($n = 538$). Of the total sample, 23% were born in countries outside North America and 14% were currently studying outside North America.

Measures

Psychology misconception questionnaire. To examine the prevalence of inaccurate beliefs about psychology, we developed a 30-item online misconception questionnaire. We only included items clearly classified as misconceptions from previous work (e.g., Kowalski & Taylor, 2009; Lilienfeld et al., 2009). Participants rated each item using a 7-point scale ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) with 4 as a midpoint (*neither agreement nor disagreement*). Unlike the traditional true/false response format employed elsewhere, the above-mentioned scale allowed students to indicate whether they strongly, moderately, or slightly agreed/disagreed with a test item. It also provided a means for them to report uncertainty in any case where they were unsure about a given question. In this study, we considered a misconception as being rejected when participants reported any level of disagreement (slight, moderate, or strong) and as being endorsed when they reported any level of agreement with a test item.

Procedure

Students were invited via e-mail to complete an online survey ''pertaining to knowledge about psychological information.'' Interested participants visited a website and completed a

Table 1. Study 1: Means, Standard Deviation, and Percentage of Misconceptions That Undergraduate, Master's, and Doctoral Students Agreed, Disagreed, and Reported Uncertainty About.

	Undergraduate			Master's			Doctoral		
Misconception Scores	*M*	*SD*	%	*M*	*SD*	%	*M*	*SD*	%
Strongly disagree	6.3	5.3	21	7.3	5.2	24	8.9	5.6	30
Moderately disagree	4.8	2.9	16	6.2	3.1	21	6.1	3.1	20
Slightly disagree	4.1	2.6	14	3.7	2.5	11	3.9	2.8	13
Unsure	4.3	3.7	14	3.5	3.7	12	3.8	3.7	13
Slightly agree	6.0	3.0	20	5.4	3.7	18	4.8	3.4	16
Moderately agree	3.4	2.6	11	2.9	2.5	10	2.0	2.0	6
Strongly agree	1.1	1.7	4	1.1	1.7	4	.6	1.2	2

consent form. They then provided demographic information regarding their gender, age, academic year, and completed the misconception questionnaire. Following the task, an information sheet was presented that informed students about the nature of the study and thanked them for their time.

Results

Our first aim was to examine the extent to which students subscribe to false psychological claims. We calculated three overall scores corresponding to the average number of misconceptions that they endorsed, rejected, or reported uncertainty about. Any level of agreement (slight, moderate, or strong) was interpreted as reflecting endorsement of a test item, while any level of disagreement was taken to indicate misconception rejection. On average, participants correctly rejected 57% of misconceptions ($M = 17.1$, $SD = 11.0$), incorrectly endorsed 30% of the misconceptions ($M = 9.1$, $SD = 7.3$), and reported uncertainty about 13% of the test items ($M = 3.9$, $SD = 3.7$; see Table 1 for an overview of misconception scores for undergraduate, master's, and doctoral students).

Education and Misconception Recognition

In order to examine whether students with greater disciplinary training endorse fewer erroneous claims, we divided participants into three groups (undergraduate, master's, and PhD) and submitted their scores to a 3 (*misconception*: endorsement vs. rejection vs. uncertainty) × 3(*student type*: undergraduate vs. Master's vs. PhD) repeated-measures analysis of variance (ANOVA) with the former factor manipulated within and the latter factor between participants. Analyses revealed a main effect for misconception, $F(2, 667) = 331.62$, $p < .001$, $\eta_p^2 = .33$, as well as a two-way interaction between misconception and student type, $F(4, 667) = 9.94$, $p < .001$, $\eta_p^2 = .03$, suggesting that misconception recognition varied significantly across the three student groups. Follow-up one-way ANOVAs indicated that students differed in the number of items that they rejected, $F(2, 669) = 10.87$, $p < .001$, $\eta_p^2 = .03$, with doctoral students ($M = 18.81$, $SD = 5.83$) disagreeing with significantly more misconceptions than either master's ($M = 17.13$, $SD = 6.11$, $p = .04$) or undergraduate students ($M = 15.22$, $SD = 3.11$; $p = .001$). A significant effect also emerged for misconception endorsement, $F(2, 669) = 13.65$, $p < .001$, $\eta_p^2 = .04$, with doctoral students ($M = 7.37$, $SD = 4.39$) affirming fewer items than their counterparts in the master's ($M = 9.34$, $SD = 5.75$; $p = .002$) and undergraduate conditions ($M = 10.51$, $SD = 5.33$; $p < .001$). Interestingly, and unlike the doctoral group, master's students failed to reject more ($p = .19$) or affirm significantly less ($p = .55$) misconceptions than their undergraduate peers. Finally, undergraduate and graduate students did not differ in the number of misconceptions that they reported uncertainty about ($p = .52$).[1]

Brief Discussion

In Study 1, we sought to track the prevalence of misconceptions beyond the borders of introductory psychology and, in particular, to examine whether advanced undergraduate and graduate students also embrace erroneous claims about the discipline. Based on previous findings, we anticipated that upper-level undergraduate and graduate students would both endorse misconceptions about the discipline, with the latter group affirming fewer and rejecting significantly more than the former. Our results broadly support this conclusion. Of the 30 misconceptions, undergraduates agreed with only 35% of items on average, a number consistent with other published studies (e.g., 39.5%: Vaughan, 1977; 38%: Gardner & Dalsing, 1986; 34–61%: Taylor & Kowalski, 2004). While graduate students also endorsed several inaccurate claims about the discipline, on average, they rejected the vast majority of misconceptions. Consistent with past work (Gardner & Hund, 1983), doctoral students were less likely to affirm erroneous claims about psychology compared to either undergraduates or master's students. However, in contrast to Arntzen et al. (2010), we found no significant difference in misconception endorsement between master's and undergraduate students. When interpreting these findings, the difference in sample sizes for each group must be considered; the majority of our respondents were doctoral level students. Furthermore, because data were collected via an online survey, it remains possible that participants had access to information that might influence their performance on our questionnaire. Completion of a similar task in a controlled setting would be necessary before strong conclusions about the prevalence of misconceptions can be drawn.

Nevertheless, this study has, for the first time, provided an indication of the approximate proportion of misconceptions endorsed by doctoral, master's, and undergraduate students and enabled a comparison to be made between these three groups. It remains to be seen, however, *why* doctoral students are less likely to endorse misconceptions of a psychological nature. We offer three different possible explanations. First, more training in the core concepts and scientific tools of the discipline may equip students with better critical thinking skills, and these skills have been shown to play a role in reducing misconceptions (Kowalski & Taylor, 2004). From this perspective, regardless of whether graduate training in psychology confers students with additional content-specific knowledge, such

training enhances students' appreciation that critical analysis of the literature is necessary before they can agree with any specific statement. Second, it is possible that graduate students possess more content-specific knowledge than their undergraduate counterparts and it is this knowledge that enables them to confidently reject inaccurate claims. Finally, students who pursue graduate training may differ in how they evaluate claims and the evidence for those claims. They might also develop a general bias toward disagreeing with any overarching statement, given the complexity of psychological phenomena and the fact that empirical findings are often subject to further qualification. It is to these latter two possibilities that we now turn.

Study 2

One limitation of Study 1 was that every item in the misconception survey was keyed in the same direction. It is therefore difficult to know whether the obtained outcomes reflected students' actual beliefs about survey content or methodological confounds such as demand compliance (e.g., "this is a test about common misconceptions thus I should disagree with everything regardless of what I believe"), a wholesale tendency toward disagreement in general or some unconsidered property of the procedure. To address this issue, we revised our misconception questionnaire in three different ways and administered it to a novel sample of students. First, we included a number of factually correct statements to determine whether graduate students differ in the amount of content-specific knowledge they possess relative to their undergraduate peers. This modification also enabled us to determine whether graduate students would agree (rather than simply disagree) with an overarching statement about psychology when it was supported by a large body of evidence (e.g., "Frequent exposure to a stimulus causes people to like it more"). Second, we revised the questionnaire, so that a correct response on half of the items required "True" to be selected (e.g., "A person's positive thoughts cannot stave off cancer"), whereas a correct response on the other half required "False" to be selected (e.g., "Some people are left-brained and others are right-brained"). If graduate students genuinely endorse fewer misconceptions than their undergraduate counterparts, then any differences between the two groups should not be moderated by question phrasing. Third, we opted for a true/false response format that also included an "Unsure" option to accommodate respondent uncertainty.

Participants in Study 1 were asked for their highest educational attainment (e.g., master's Year 1, PhD Year 3) rather than the number of psychology courses completed. Consequently, students at the same educational level (PhD Year 1) may have differed considerably in their disciplinary training (e.g., 3 vs. 30 psychology courses). Our initial sample was also recruited from a social/personality society and may have overrepresented specific areas within the discipline. With this in mind, Study 2 controlled for psychological training and number of years spent in university and included students from all areas of the discipline (e.g., clinical, health, cognitive psychology). These adjustments will serve to increase the generalizability of our findings.

Finally, it may be that specific cognitive and/or personality characteristics of students play a role in how susceptible they are to misconceptions. For instance, students who opt for graduate training may differ in how they evaluate claims (and the evidence for those claims) relative to their undergraduate peers. It is also possible that there are important individual differences between undergraduate students—regardless of how many psychology courses that have completed—that predict the likelihood of misconception endorsement. In order to test this assumption, we administered the Need for Cognition (NFC) Scale (Cacioppo & Petty, 1982) immediately after the misconception questionnaire. The NFC Scale assesses the propensity to engage in effortful and complex thinking. Individuals who score highly on this measure are more likely to search for additional information before making a decision, less likely to be influenced by blatant attempts at priming, and tend to think more about a wide variety of topics—including their own thoughts—than their low-scoring counterparts (see Petty, Briñol, Loersch, & McCaslin, 2009). It might be that a disposition for engaging in and enjoying effortful thinking buffers against misconception endorsement. To our knowledge, no research has explored the potential relation between individual differences in need for cognition and susceptibility to psychological misconceptions.

Method

Participants

A convenience sample of 586 students (458 women, 128 men) ranging in age from 18 to 55 years ($M = 21.3$, $SD = 4.2$) were recruited from 4 North American universities. Fifty-one percent were Asian American, 31% were European American, and 17% were of Hispanic American ethnicity. Mean years spent in university was 2.6 ($SD = 1.9$) and the median number of psychology classes taken was 4. Although undergraduate students participated in exchange for course credit, graduate students completed the questionnaire on a voluntary basis. Data were only included for students who were working toward the completion of a psychology undergraduate ($n = 519$), master's ($n = 7$), or doctoral level qualification ($n = 31$) and had not participated in Study 1 (final $N = 557$).

Measures

Psychology Misconception Questionnaire. A modified version of the Psychology Misconception Questionnaire (PMQ) was employed, which differed from its predecessor in three ways. We expanded the task from 30 to 42 items—7 of which consisted of factually correct statements (e.g., "The human brain can be sub-divided into four different lobes"). The remaining 35 items were split so that True and False were correct answers about half of the time. An option of Unsure was also included.

Table 2. Study 2: Correlations Among All Variables of Interest.

	Agree	Unsure	Time at University	Psychology Courses	Need for Cognition
Disagree	−.54	−.56	.44	.38	.28
Agree		−.39	−.29	−.19	−.11
Unsure			−.19	−.22	−.19
Time at university				.49	.24
Psychology courses					.14

Note. All scores are significant at the $p < .01$ level.

NFC scale. NFC was assessed using the short (18-item) version of the scale. Participants responded to statements such as "The notion of thinking abstractly is appealing to me" and "Learning new ways to think doesn't excite me very much" (reverse scored) using a response format that ranged from −4 (*very strong disagreement*) to 4 (*very strong agreement*) with 0 as a neutral point (*neither agree nor disagree*).

Procedure

Students received notification of an online survey "pertaining to knowledge about psychological information" via an e-mail announcement or a departmental recruitment system. Those who agreed to participate were forwarded to a web page that asked them to provide demographic information and complete the PMQ as well as NFC scale. Thereafter, students were thanked, debriefed, and dismissed. The entire task took less than 1 hr to complete.

Results

We calculated three overall scores for each student corresponding to the average number of misconceptions they endorsed, rejected, or reported uncertainty about. As noted earlier, to reject a misconception, participants had to select False on half of the test items (e.g., "Some people are left-brained and others are right-brained") and True on the other half (e.g., "People with schizophrenia do not have multiple personalities"). To simplify analyses, we reverse scored the latter set of items, so that a true response always indicated misconception endorsement, while a false response indicated misconception rejection. Finally, and given the relatively small number of master's students in the current sample, we collapsed both master's and PhD students into one overarching group (graduate students).

To determine whether performance on the misconception questionnaire varied as a function of psychological training, we submitted the above-mentioned data to a 3 (*misconception*: endorsement vs. rejection vs. uncertainty) × 2 (*student type*: graduate vs. undergraduate) repeated measures ANOVA. Analyses revealed a main effect for misconception, $F(2, 554) = 191.20$, $p < .001$, $\eta_p^2 = .26$, as well as a significant interaction between misconception and student type, $F(2, 554) = 75.84$, $p < .001$, $\eta_p^2 = .12$. To qualify this interaction, test scores for both groups were submitted to a series of one-way ANOVAs. Analyses revealed that graduate students rejected significantly more misconceptions ($M = 27.1$, $SD = 5.6$) than their undergraduate counterparts ($M = 16.3$, $SD = 5.4$), $F(1, 555) = 141.09$, $p < .001$, $\eta_p^2 = .20$. At the same time, they also endorsed fewer erroneous claims ($M = 10.0$, $SD = 4.6$) than the latter group ($M = 17.5$, $SD = 5.1$), $F(1, 555) = 75.49$, $p < .001$, $\eta_p^2 = .12$, and responded with lower levels of uncertainty ($M = 4.9$, $SD = 5.8$) than undergraduate students ($M = 8.2$, $SD = 5.4$), $F(1, 555) = 12.91$, $p < .001$, $\eta_p^2 = .02$.

One possibility arising from Study 1 was that the observed difference in questionnaire performance between undergraduate and graduate students may have represented a response bias on the part of the latter group toward rejecting overarching statements about the discipline. If correct, then this tendency should lead to clear differences between the two groups when responding to factually correct items. When scores for the factually correct items were submitted to a similar set of analyses as mentioned earlier, we found no difference between the two groups in how much they endorsed those statements, ($M = 4.2$, $SD = 1.0$, vs. $M = 4.2$, $SD = 1.2$), $F(1, 555) = .01$, $p = .92$. In other words, instead of simply rejecting every item they encountered, graduate and undergraduate students tended to agree with the majority of claims about the discipline when those statements were supported by a large body of empirical evidence.[2]

Relationship between misconceptions, psychological training, years spent at university, and NFC. Although we divided participants into undergraduate and graduate students in order to compare their performance on our questionnaire, such an approach may mask important relationships between years spent at university, psychology courses completed, need for cognition, and susceptibility to misconceptions. Therefore, we computed a correlation matrix that explored the relationship between these various factors and misconception scores (see Table 2). Analyses revealed that disagreement with test items was positively related to the amount of time spent at university and to a lesser extent the number of psychology courses completed. An inverse set of correlations was evident for misconception endorsement, with participants more likely to agree with (and report uncertainty about) misconceptions when they had spent less time at university and completed fewer psychology courses. Finally, students' need for cognition scores were positively correlated with misconception rejection, greater number of psychology courses completed, and amount of time spent at university.

Table 3. Study 2: Results From Hierarchical Multiple Regression Analyses Using Years Spent in University, Psychological Training, and Need for Cognition to Predict Misconception Disagreement, Agreement, and Uncertainty.

Misconception	Step	Predictor	*B*	*SE B*	*B*	*T*	*p*
Disagreement	1	Years in university	1.38	.12	.44	11.46	.001
	2	Years in university	1.03	.14	.33	7.61	.001
		Psych courses	.19	.04	.22	5.11	.001
	3	Years in university	.90	.14	.29	6.64	.001
		Psych courses	.19	.04	.22	5.11	.001
		Need for cognition	.05	.01	.18	4.72	.001
Agreement	1	Years in university	−.82	.12	−.29	−7.10	.001
	2	Years in university	−.71	.13	−.25	−5.37	.001
		Psych courses	−.06	.04	−.07	−1.58	.12
	3	Years in university	−.69	.14	−.24	−5.05	.001
		Psych courses	−.06	.04	−.07	−1.56	.001
		Need for cognition	−.01	.01	−.04	−1.02	.30
Unsure	1	Years in university	−.56	.12	−.19	−4.64	.001
	2	Years in university	−.32	.04	−.16	−3.48	.001
		Psych courses	−.13	.04	−.17	−3.52	.001
	3	Years in university	−.22	.14	−.08	−1.56	.12
		Psych courses	−.13	.04	−.16	−3.48	.001
		Need for cognition	−.04	.01	−.15	−3.62	.001

Note. *SE* = standard error.

Finally, to determine which of the above-mentioned factors best predicted misconception endorsement, rejection, or uncertainty, we carried out a series of hierarchical multiple regression analyses (the results of which are presented in Table 3). In each case, the number of years spent at university was entered in Step 1, psychological training in Step 2, and need for cognition in Step 3. In conducting these analyses, we were able to estimate the unique portion of variance that each variable shared with misconception scores when controlling for all other variables (main effects and interactions).

With respect to misconception rejection, years spent at university predicted test performance at the first step, $r^2 = .19$, $F(1, 554) = 131.38$, $p < .001$. Entering psychological training at the second step, R^2 change $= .04$, $F(1, 553) = 26.11$, $p < .001$, and need for cognition at the third step resulted in a significant addition to the prediction of the model, for a total R^2 of .26, $F(1, 552) = 22.29$, $p < .001$, $f^2 = .35$. Interestingly, this pattern of findings did not emerge for misconception endorsement. While years spent at university did predict test performance at the first step, $r^2 = .08$, $F(1, 555) = 50.32$, $p < .001$, adding psychological training and need for cognition offered no significant increase in the prediction of the model, R^2 change $= .02$, $F(1, 555) = 1.05$, $p = .31$. With all three variables in the equation, time at university made a significant contribution to the prediction of misconception agreement, $t(552) = 7.10$, $p < .001$, but psychological training, $t(552) = 1.56$, $p = .12$, and need for cognition did not, $t(552) = 1.02$, $p = .31$. Put simply, a greater number of years spent at university predicted the number of misconceptions participants agreed with above and beyond the number of psychology courses they had completed or their individual need for cognition.

Finally, entering time spent in university at the first step significantly predicted misconception uncertainty, $r^2 = .04$, $F(1, 554) = 21.61$, $p < .001$. Entering psychological training at the second step, R^2 change $= .02$, $F(1, 553) = 12.35$, $p < .001$, and need for cognition at the third step resulted in a significant addition to the prediction of the model, for a total R^2 of .08, $F(1, 552) = 13.11$, $p < .001$, $f^2 = .09$. This time, with all three variables in the equation, years spent at university did not make a significant contribution to the prediction of misconception uncertainty, $t(552) = 1.5$, $p < .12$, but psychological training, $t(552) = 3.5$, $p = .001$, and need for cognition did, $t(552) = 3.6$, $p < .001$. In other words, it appears that the number of psychology courses completed and need for cognition predict how frequently students report uncertainty about misconceptions, above and beyond the time spent in university.

Brief Discussion

Consistent with Study 1, graduate students agreed with fewer, disagreed with more, and reported lower levels of uncertainty about misconceptions relative to their undergraduate counterparts. Both groups were equally likely to affirm general statements about the discipline when those claims were factually correct or supported by a large body of empirical evidence. A series of correlational and regression analyses revealed that as the number of years students spent at university increased, the probability of agreeing with misconceptions decreased—regardless of the number of psychology coursed they had completed or their need for cognition. However, including psychological training and need for cognition in the model increased our ability to predict whether participants disagreed or reported uncertainty about misconception items.

General Discussion

This article set out to address two interrelated questions. On one hand, we were interested in whether common but inaccurate beliefs about psychology would be endorsed by students' new the discipline as well as those with extensive training in its core concepts and values. Until recently, the vast majority of work has focused on introductory students and very rarely tracked misconceptions in upper-level undergraduate (Glass, Bartels, Ryan, & Stark-Wroblewski, 2008) and graduate students (Arntzen et al., 2010). Across two separate studies, we provide converging evidence that students readily recognize

and reject the majority of misconceptions that they encounter—with graduates significantly better at doing so relative to undergraduates. Nevertheless, it should be noted that undergraduates continued to endorse a number of items in both of our studies (35% in Study 1 and 50% in Study 2) as did their graduate peers (31% in Study 1 and 29% in Study 2). Several possible explanations present themselves. First, these scores could reflect genuinely faulty beliefs about the discipline and if so, they serve to underscore the difficulties in combating misconceptions. Second, we cannot rule out the possibility that the above-mentioned scores were influenced by features of the measurement procedures themselves, such as item phrasing or response format used (see Hughes, Lyddy, & Kaplan, 2013; Taylor & Kowalski, 2012). Finally, students may have responded to a number of test items as being "partially incorrect but not entirely false" (e.g., Gardner & Brown, 2012). In other words, several items on our questionnaire may contain a "kernel of truth" or be true some of the time, but not generally. Consider, for example, the notion that "opposites attract." Although it is entirely possible that minor differences between romantic partners contribute to a more interesting and varied relationship, people typically select mates that are similar to themselves in personality, attitudes, and values (e.g., Buston & Emlen, 2003; Hitsch, Hortaçsu, & Ariely, 2009).

We were curious to know whether misconceptions would diminish as a function of university education and/or psychological training. Consistent with past findings, more time spent in university and the number of psychological courses completed predicted higher levels of misconception rejection. However, in contrast to Gardner and Dalsing (1986)—who found that psychological training was a better predictor of misconceptions than university education—we found that only the latter and not the former predicted misconception *endorsement*. These findings suggest that differences in domain-specific knowledge may not be the reason why undergraduates affirm more misconceptions relative to their graduate peers in Study 2. If master's and doctoral students simply acquired more information about the discipline, psychological training should have predicted susceptibility to misconceptions above and beyond years spent at university. Graduate students should also have affirmed significantly more factually correct items than undergraduates—yet this did not appear to be the case. Both groups of students were effective in identifying and supporting test items that were factually correct or supported by a large body of evidence. Thus, it may be that generic skills acquired during university—such as the ability to critically evaluate a knowledge claim—are cultivated and practiced with increased frequency as one advances from the initial stages of study to a position of academic maturity. Although a firm answer to the above-mentioned question lies beyond the remit of this article, future work could set out to disentangle the specific properties of university and psychological training that influence student's susceptibility to psychological misconceptions. Moreover, given that we relied on a small set of factually correct statements in order to test domain-specific knowledge, future work could also examine whether our findings continue to hold when a more robust test with a larger set of factual items are employed.

Our findings reveal that a propensity to engage in effortful and complex thinking (i.e., a need for cognition) can also help students detect misconceptions about psychology. Individuals intrinsically motivated to evaluate the world around them and seek out complex ideas or tasks were less susceptible to erroneous claims compared to those who would rather avoid effortful cognitive work. However, it should be noted that need for cognition bears more than a passing resemblance to another variable that is central to misconception rejection (i.e., critical thinking). This latter factor broadly refers to a disposition toward and ability to retrieve information to evaluate knowledge claims with the goal of generating sound conclusions from that information in a transcontextual fashion (see Halpern, 2007). Both need for cognition and critical thinking predict academic performance (Sadowski & Gulgoz, 1996; Williams, Oliver, & Stockdale, 2004), misconception endorsement (Kowalski & Taylor, 2004), and perhaps most importantly, correlate significantly with one another (Stedman, Friedel, Rhoades, Ricketts, & Irani, 2009; West, Toplak, & Stanovich, 2008). Although a number of authors have explored critical thinking in the context of psychological misconceptions, this article is the first to connect need for cognition to that same domain. Thus, it may be useful to clarify the relationship between critical thinking and need for cognition as well as identify strategies for their cultivation in situations where they are absent. Taking a step back, this work also illustrates the utility of attending to specific cognitive or personality variables that may influence a student's likelihood of believing inaccurate claims about the discipline. Such factors may serve to highlight subsections of the student population that could benefit from more intensive or directed educational efforts. For example, it may be that need for cognition is only one of a possible myriad of individual differences that predict how readily students affirm misconceptions inside and outside the classroom.

Some final points are worth considering here. Although misconceptions about mental illness, memory, and legal phenomena may influence a host of "real-world" outcomes (Lilienfeld et al., 2009), few researchers have sought to put this claim to the test (although see Shaw & Woodworth, 2013). Given that the prevalence and persistence of misconceptions have been increasingly subject to empirical scrutiny, a logical next step may be to conduct "translational" research that explicates the link between specific misconceptions and real-world decision making. For instance, do misconceptions about eyewitness testimony, the "lie-detecting" abilities of the polygraph, or false confessions increase the likelihood of a student punishing a suspect in a "mock-crime" scenario when only the above forms of evidence are offered? While misinformation about childhood vaccines and autism has been shown to lead to reductions in vaccination rates (Lewandowsky et al., 2012), would students who endorse homeopathy or alternative medicines recommend these treatments to other students in place of traditional medicine? Similarly, do misconceptions about mental illness influence how closely students sit beside, interact with, or offer to help a confederate who was "diagnosed"

with schizophrenia, bipolar disorder, or clinical depression? Each of the foregoing examples could be modified by educators for use in the classroom and demonstrate how misconceptions can be leveraged as an engaging and vivid instructional tool. Researchers could also create experimental measures from these examples in order to investigate whether (a) misconceptions inform and guide real-world biases, (b) interactive strategies are an effective means of combating erroneous beliefs, and (c) observed changes in misconceptions persist longer relative to other instructional strategies (e.g., Kowalski & Taylor, 2009).

It is worth noting that the current findings are entirely correlational in nature and were collected online via an open advertisement (Study 1) or departmental sign-up system (Study 2). Although such a design has obvious benefits (e.g., access to large sample of psychology students from around the world), it is subject to several limitations including an inability to control access to task-relevant information or even the duration of questionnaire completion. Indeed, given that a convenience sampling method was used, far more graduate relative to undergraduate students participated in Study 1 and vice versa in Study 2. In addition, properties of the sample (ethnicity) in the latter study were not representative of the student population as a whole. With this in mind, future work could replicate the current findings while systematically manipulating the above-mentioned factors in a controlled (laboratory or classroom) setting. Doing so would clarify the relative importance of general university versus psychology-specific training in undermining erroneous claims about the discipline. It would also serve to increase the generalizability of our findings and ensure that they are not constrained to specific subsections of the student population.

Conclusion

In this article, we provide the first systematic analysis of the prevalence of misconceptions as a function of educational level, psychological training, and individual differences in need for cognition. Overall, our results indicate that while inaccuracies about the discipline diminish as students' educational experience increase, graduate students continue to endorse a small number of misconceptions in the face of extensive disciplinary training (although it should be noted that students pursuing doctoral training appear to recognize and reject a greater number of inaccuracies relative to their counterparts at the master's or undergraduate level). Given the persistence or ''stickiness'' of common misconceptions about psychology, it is entirely possible that graduate students (and even faculty) who endorse pseudoscientific thinking and beliefs actually transmit misconceptions to the next generation of students in their role as teaching assistants, tutors, or lecturers. We therefore recommend that further work investigate this possibility in addition to the other potential sources of misconceptions that have been identified (but not tested) in the wider literature (Lewandowsky et al., 2012; Lilienfeld et al., 2009). Such work would provide valuable insight into the potential sources of psychological misconceptions—a necessary step for their elimination.

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Notes

1. Conducting the above-mentioned analyses with gender added as an additional factor also resulted in a two-way interaction between Misconception and Gender, $F(2, 667) = 9.69$, $p < .001$, $\eta_p^2 = .01$, such that women affirmed more, $F(1, 667) = 13.86$, $p < .001$, $\eta_p^2 = .02$, and rejected fewer misconceptions compared to men, $F(1, 667) = 10.51$, $p = .001$, $\eta_p^2 = .02$. Note that a three-way interaction between Misconceptions, Student Type, and Gender was not observed.
2. It should be noted that a significant effect was also obtained for the number of factually correct items graduate and undergraduate students disagreed with ($M = 2.6$, $SD = .89$, vs. $M = 2.1$, $SD = 1.1$), $F(1, 555) = 7.35$, $p = .01$, $\eta_p^2 = .01$, and reported uncertainty about ($M = .26$, $SD = .64$, vs. $M = .77$, $SD = 1.1$), $F(1, 555) = 8.42$, $p = .01$, $\eta_p^2 = .02$. However, we refrain from making any strong claims in this particular instance, given that the absolute magnitude of the mean differences and effect sizes is so small they are practically meaningless.

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