Richmond, A. S., Rauer, H. M., Klein, E. (2015). How does metacognition predict beliefs in psychological and educational misconceptions? *The Researcher, 27*(1), 20-24.

How does Metacognition Predict Beliefs in Psychological and Educational Misconceptions?

Aaron S. Richmond, Hannah M. Rauer, and Eric Klein
Metropolitan State University of Denver

Abstract: *The purpose of this study was to investigate how metacognitive beliefs may predict prevalence or susceptibility to psychological and educational misconceptions. A total of 430 participants completed six online measures to gauge their susceptibility to common misconceptions and their level of metacognition. Results indicated that a higher level of metacognition was negatively correlated with susceptibility to psychological and educational misconceptions. The present study demonstrated that there are varying levels of misconceptions on psychological and educational topics in the college student population. Therefore, it is important that instructors know how to prime and teach metacognitive strategies to their students to help overcome misconceptions. Suggestions for future research include recruiting participants from different age groups and using different ways to measure how metacognition may predict susceptibility to psychological and educational misconceptions.*
Keywords: *Metacognition, Misconceptions, False-Beliefs, Self-Efficacy*

Prior to entering educational and psychological courses, many students have pre-formed naïve theories of how humans learn that are often misconceived (Taylor & Kowalski, 2004). Misconceptions can be difficult to eliminate (Taylor & Kowalski, 2004), and are known to be related to both academic performance (Kuhle, Barber, & Bristol, 2009) and critical thinking skills (Taylor & Kowalski, 2004). Thus, from a teaching standpoint, it is important to strive to combat misconceptions and instill critical thinking and skepticism in students (Beins, 2014).

Educational and psychological misconceptions appear to be widespread among all populations regardless of socioeconomic status; however taking college-level psychology courses may reduce the support of many popular psychology myths (Kuhle et al., 2009). Research has shown a key contributor to psychological misconceptions is having limited personal experiences or interactions in the field of psychology (Taylor & Kowalski, 2004). An inverse relationship exists between the number of psychology courses taken and the reduction of psychology-related misconceptions (Glass, Bartels, Ryan, & Stark-Wroblewski, 2008). An additional approach is to encourage students to look critically at their own behaviors, metacognitive study methods, and to self-evaluate if they have good practices for questioning assumptions. It is presently unknown whether metacognitive strategies learned through psychology and education in general helps reduce the number of misconceptions held. We attempted to address this gap in the literature with this study.

It remains questionable whether academic performance in education and psychology courses is negatively correlated with less myth acceptance and lower levels of misconceptions. Few studies have focused on correlates and predictors of educational and psychological misconceptions (e.g., Kowalski & Taylor, 2009). There is evidence that high levels of self-efficacy and metacognition are related to academic performance (Aurah, 2013). This may suggest that

For questions regarding this article please contact Dr. Aaron S. Richmond at Department of Psychology; Metropolitan State University of Denver; Campus Box 54; PO Box 173362; Denver, CO 80217-3362; E-mail: arichmo3@msudenver.edu

metacognition plays an important role in the learning process. Research has not been conducted on investigating how metacognition relates to misconceptions in the field of psychology. The purpose of this study was to investigate how metacognitive beliefs (e.g., metacognitive awareness, calibration, cognitive and learning strategy use) may predict prevalence or susceptibility to psychological and educational misconceptions. We hypothesized that individuals with low levels of metacognition would be more susceptible to believe in psychological and educational misconceptions.

METHOD

PARTICIPANTS

Undergraduate college students (N = 430, 185 male, 232 female, of ages from 18 to 52, M_{age} = 23.38 years) participated in this study in exchange for partial course credit. The reported ethnic makeup of the sample was: 62.33% Caucasian, 17.91% Hispanic/Latino, 5.12% Asian, 3.49% African American, 0.70% Arab, and 10.46% multiracial or unreported. Students identified as 47.21% freshman, 26.05% sophomore, 19.91% junior, 5.58% senior, and 2.79% post baccalaureate with an average GPA of 3.44 (SD = 5.07).

MATERIALS

Prevalence of misconceptions was assessed using a 65-item survey based on research by Amsel et al. (2009), Kuhle et al. (2009), Standing and Huber (2003). Participants rated statements on this survey as true or false, and more numerous incorrect ratings reflect a higher misconceptions score. The *gamma* calibration parameter (Nietfeld, Enders, & Schraw, 2006) was measured using a 15-item test, in which participants identified the definition of a word and then rated their confidence in the answer. *Need for cognition* (Cacioppo & Petty, 1982) was measured using the 18-item Need for Cognition Scale short form (NCS; Cacioppo, Petty, Feinstein, & Jarvis, 1996). *Regulation of cognition* was measured using the 52-item Metacognitive Awareness Inventory (MAI; Schraw & Dennison, 1994). Participants' *memory related self-efficacy* was measured using the Memory for Self-Efficacy Questionnaire (Berry, West, & Dennehey, 1994). Six factors: *intrinsic goal orientation, extrinsic goal orientation, task value, control of learning beliefs, self-efficacy for learning and performance,* and *test anxiety* were measured by subscales of the Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, and McKeachie, 1991). Participant demographics including age, ethnicity, gender, GPA and school year were also recorded.

PROCEDURE

Participants volunteered for and completed the surveys online. First, participants were presented informed consent information, followed by each survey measure and the demographics questionnaire. The MSEQ scale was however, always presented first or last and this order was counterbalanced. The nature of the MSEQ measure required each section to be presented in sequence, and the Sona Systems portal could not randomize this component without disordering the subscales. Once participants completed their survey responses, they received debriefing information and signed off.

RESULTS

To examine the strength of metacognitive factors in predicting susceptibility to psychological and educational misconceptions, a stepwise multiple regression analysis was performed. Prior to entry into the regression model, each factor was inspected for outliers,

normality, and multicolinearity. Outlier cases exceeding *z*-scores of +/- 3.00, or those missing data for scales listwise were excluded (N = 114; Abu-Bader, 2010).

The resulting analysis yielded 10 significant regression models predicting susceptibility to misconceptions; where the final model accounted for the greatest amount of variance R^2 = .279, R^2_{Adj} = .260, $F(8, 315) = 12.44$, $p < .001$. Gamma was a negative predictor of misconceptions, accounting for the largest portion (9.11% percent) of the variance. Other negative predictors were: need for cognition, regulation of cognition, self-efficacy for learning preferences, and control of learning beliefs. Self-efficacy for memory, intrinsic goal orientation, and extrinsic goal orientation were positive predictors of misconceptions. In other words, when students had lower levels of metacognition, they were more susceptible to believing educational and psychological myths. See Table 1 for regression coefficients.

Table 1. *Multiple Regression Coefficients of Metacognition Factors Predicting Misconception*

	Variable Summary	Model Summary			
Variables	β weights	*R*	R^2_{Adj}	*t*	*F* value
In the equation					
Gamma	-.239	.306[a]	.091[a]	-4.913***	$F_{2, 321} = 23.37$ [a] ***
Need for Cognition	-.286	.389[b]	.144[b]	-5.011***	$F_{4, 319} = 18.84$ [b] ***
Regulation of Cognition	-.177	.437[c]	.181[c]	-3.292**	$F_{5, 318} = 16.38$ [c] ***
Memory Self Efficacy	.144	.453[d]	.192[d]	2.922**	$F_{6, 317} = 14.77$ [d] ***
S.E. For Learning Pref.	-.253	.467[e]	.204[e]	-3.913***	$F_{7, 316} = 14.80$ [e] ***
Intrinsic Goal Orientation	.260	.497[f]	.230[f]	4.119***	$F_{8, 315} = 14.25$ [f] ***
Extrinsic Goal Orientation	.190	.515[g]	.247[g]	3.567***	$F_{9, 316} = 16.23$ [g] ***
Control of Learning Belief	-.153	.528[h]	.248[h]	-2.482*	$F_{10, 315} = 15.21$ [h] ***
Not in the equation					
Task Value	-.066			0.901	
Test Anxiety	.027			0.498	

Note. (*) = $p < .05$, (**) = $p < .01$(***) = $p < .001$; Constant B = 0.715. [a]Predictors in the model: (constant), Gamma; [b]Predictors in the model: (constant), Gamma, Need for Cognition; [c]Predictors in the model: (constant), Gamma, Need for Cognition Regulation of Cognition; [d]Predictors in the model: (constant), Gamma, Need for Cognition Regulation of Cognition, Memory Self Efficacy; [e]Predictors in the model: (constant), Gamma, Need for Cognition Regulation of Cognition, Memory Self-Efficacy, Self-Efficacy for Learning Preferences; [f]Predictors in the model: (constant), Gamma, Need for Cognition Regulation of Cognition, Memory Self-Efficacy, Self-Efficacy for Learning Preferences, Intrinsic Goal Orientation; [g]Predictors in the model: (constant), Gamma, Need for Cognition Regulation of Cognition, Memory Self-Efficacy, Self-Efficacy for Learning Preferences, Intrinsic Goal Orientation, Extrinsic Goal Orientation; [h]Predictors in the model: (constant), Gamma, Need for Cognition Regulation of Cognition, Memory Self-Efficacy, Self-Efficacy for Learning Preferences, Intrinsic Goal Orientation, Extrinsic Goal Orientation, Control of Learning Belief.

DISCUSSION

The purpose of this study was to investigate how metacognitive beliefs (e.g., metacognitive awareness, need for cognition, and cognitive/learning strategy use) may predict susceptibility to psychological and educational misconceptions. We hypothesized that individuals with high levels of metacognition would be less likely to believe in psychological and educational misconceptions. Our results were consistent with past research. The calibration

measure, Gamma, accounted for more variability than any of the other investigated variables in the present study.

IMPLICATIONS

Participants' confidence levels in their beliefs on common misconceptions varied substantially. The high number of misconceptions about psychology and educational topics held by college students is worrisome as it may result in the strengthening or retention of inaccurate beliefs (Taylor & Kowalski, 2004). Misconceptions are related to academic performance (Kuhle et al., 2009) and critical thinking skills (Taylor & Kowalski, 2004). Teachers and classroom instructors may be able to prime students using metacognitive strategies to improve academic performance (Aurah, 2013). Educators may also consider teaching students to think critically about the information that they encounter in the general population, which will build skill at evaluating the source, accuracy, and reliability of supporting data that may or may not substantiate claims (Beins, 2014). We have not established which specific metacognitive strategies are most effective to actively combat misconceptions, once instilled. Individualized traits that contribute to susceptibility for believing in misconceptions remain unknown.

FUTURE RESEARCH

One suggestion for future research is to sample different age groups within the general population. Research shows potential age differences in prior held knowledge and confidence in that knowledge (Cyr & Anderson, 2013). Therefore, age could potentially impact Gamma scores and produce different results if expanded or not considered in analysis. We suggest that future research might group participants into three age categories (adolescent, middle adult, and elderly adult) to compare results between age groups. Since Gamma illustrates differences between acquired knowledge and levels of confidence in the belief of that knowledge (Schraw et al., 2013), examining and analyzing Gamma scores within each of these populations could prove useful. Individuals with more life experience (middle adults and elderly adults) may demonstrate higher overall understanding of shortcomings in their knowledge. These individuals may score differently on Gamma and may be more receptive to changing their misconceptions about psychology and education.

CONCLUSION

Research into how metacognition relates to misconceptions is a valuable use of resources. The relationship between metacognition and susceptibility to misconceptions has an important influence over how we create the beliefs we hold, and how resistant our belief systems are to change. The present study was able to show varying levels of misconceptions among a sample of college students. These results indicate the need to understand ways in which we can overcome misconceptions and hold more accurate beliefs overall. By teaching students how to challenge common thoughts and beliefs, we can affirm the science of psychology and improve education (Beins, 2014). The pursuit of challenging susceptibility to misconceptions will also build a robust critically thinking population and cognitively responsible society.

REFERENCES

Abu-Bader, S. H. (2010). *Advanced & multivariate statistical methods for social science research with a complete SPSS guide.* Chicago, IL: Lyceum Books, Inc.

Amsel, E., Johnston, A., Alvarado, E., Kettering, J., Rankin, L., & Ward, M. (2009). The effect of perspective on misconceptions in psychology: A test of conceptual change theory. *Journal of Instructional Psychology*, *36*(4), 289-295.

Aurah C. M. (2013). The effects of self-efficacy beliefs and metacognition on academic performance: A mixed method study. *American Journal of Educational Research, 8*, 334-343. doi:10.12691/education-1-8-11

Beins, B. (2014, April 26). *Skeptical but Not Cynical: The Importance of Critical Thinking.* APA Harry Kirke Wolfe Distinguished Lecture given at the meeting of the Rocky Mountain Psychological Association (RMPA) Eighty-fourth Annual Convention, Salt Lake City, UT.

Berry, J. M., West, R. L. & Dennehey, D. M. (1989). Reliability and validity of the Memory Self-Efficacy Questionnaire. *Developmental Psychology, 25*(5), 701-713. doi:10.1037/0012-1649.25.5.701

Cyr, A. A., & Anderson, N. D. (2013). Updating misconceptions: Effects of age and confidence. *Psychonomic bulletin & review*, *20*(3), 574-580. doi: 10.3758/s13423-012-0357-

Kowalski, P., & Taylor, A. K. (2009). The effect of refuting misconceptions in the introductory psychology class. *Teaching of Psychology, 36*(3), 153-159. doi:10.1080/00986280902959986

Kuhle, B. X., Barber, J. M., & Bristol, A. S. (2009). Predicting students' performance in introductory psychology from their psychology misconceptions. *Journal of Instructional Psychology, 36*(2), 119-124.

Nietfeld, J. L., Enders, C. K., & Schraw, G. (2006). A Monte Carlo comparison of measures of relative and absolute monitoring accuracy. *Educational and Psychological Measurement*, 66, 258–271. doi:10.1177/0013164404273945.

Pintrich, P. R., Smith. D. A., Garcia, T., & McKeachie. W. (1991) *A manual for the use of the motivated strategies for learning questionnaire.* Ann Arbor, MI: University of Michigan.

Schraw, G., & Dennison, R. S. (1994). Assessing metacognitive awareness. *Contemporary Educational Psychology, 19*(4), 460-475. doi:10.1006/ceps.1994.1033

Schraw, G., Kuch, F., & Gutierrez, A. P. (2013). Measure for measure: Calibrating ten commonly used calibration scores. *Learning and Instruction, 24*, 48-57. doi:10.1016/j.learninstruc.2012.08.007

Standing, L. G., & Huber, H. (2003). Do psychology courses reduce beliefs in psychological myths? *Social Behavior & Personality: An International Journal*, *31*(6), 585-585. doi:10.2224/sbp.2003.31.6.585

Taylor, A. K., & Kowalski, P. (2004). Naïve psychological science: The prevalence, strength, and sources of misconceptions. *The Psychological Record, 54*(1), 15-25.