



A test of contemporary misconceptions in psychology

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ARTICLE INFO

Article history:

Received 22 January 2012

Received in revised form 11 October 2012

Accepted 22 December 2012

Keywords:

Misconceptions in psychology

Psychology myths

Measurement

Psychological topics

Media influences

ABSTRACT

The purpose of this study was to construct and evaluate a contemporary misconception test based on popular myths in psychology. Misconceptions in psychology are commonplace, strongly held, and can be problematic for teaching accurate information. This study examined several predictors of misconceptions in eleven psychological topic areas. We also evaluated test construction by comparing statements worded as true versus false. Participants were 137 undergraduate students from two higher education institutions. On average, participants believed misconceptions to be partly true and partly false. There were significant differences in misconception levels between the 11 topic areas. Reported reading of news magazines predicted lower misconception scores. We found no difference between statements presented in true versus false formats. Internal consistency of the scale was high ($\alpha = .85$). We conclude that students continue to believe many popular misconceptions and that identification and refutation of those misconceptions is necessary as part of the instructional process.

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Misconceptions are widely held beliefs contradicted by established scientific evidence. They are common in fields as diverse as physics (Hammer, 1996; McCloskey, 1983), chemistry (Ozmen, 2004), mathematics (Lochead & Mestre, 1988), and physiology (Michael, 2002). Particularly pervasive are misconceptions in the field of psychology. Lilienfeld, Lynn, Ruscio, and Beyerstein (2010) have recently described 50 widely held myths about psychology and refuted each misconception with research evidence. Everyone, it seems, can be an “amateur psychologist” in that observation and speculation of human behavior is widely accessible, regardless of formal education or training. Personal theories about behavior abound, and are frequently based on intuition and little scientific evidence. A widely held belief expressed by many non-psychologists is that psychology is merely common sense. As many scientists have observed, common sense is not so common, and as Lilienfeld (2010a) noted, “psychological science often requires us to mistrust our common sense and set aside our intuitions” (p. 38).

The accepted role of common sense and intuition is becoming increasingly commonplace even within the field of psychology, which may perpetuate misconceptions. Recently, Lilienfeld (2010b) documented instances of what he termed the “resurrection of common sense and intuition as arbiters of scientific truth” (p. 285). He notes several instances where prominent psychologists publishing in leading psychology journals such as the *American Psychologist* and *Psychological Bulletin* have advocated for the important role of

common sense in evaluating psychological theories. He also cited statements by the *APA Presidential Task Force on Evidence-Based Practice* (2006) that in some instances intuition and clinical judgment deserve the same priority as scientific evidence.

There is a long history of studies on psychological misconceptions, beginning in the early 20th century. Several contemporary studies have documented the widespread nature of psychological misconceptions among college students (Della Sala, 1999, 2007; Gardner & Dalsing, 1986; Mercer, 2010) and even amongst academicians (Gardner & Hund, 1983). These beliefs are often strongly held. Studies on whether exposure to courses in psychology reduces the prevalence of false beliefs have produced mixed findings. Earlier studies found that completion of an introductory psychology course resulted in a very limited change in students' false beliefs (McKeachie, 1960; Vaughn, 1977). However, Gardner and Dalsing (1986) found a significant decrease in misconceptions as college students completed greater numbers of college credit hours in general and, more specifically, greater numbers of credit hours in psychology courses. Similarly, Furnham (1993) found psychology students held fewer misconceptions than non-psychology students did. McCutcheon, Furnham, and Davis (1993) found British college students were less susceptible than Americans to misconceptions.

Lilienfeld (2010b) outlined possible sources of commonly held misconceptions including word of mouth, a desire for quick and easy solutions to complicated problems, selective perception and memory, inference of causation from correlation, and misleading media information. Lewandowsky, Decker, Seifert, Schwarz, and Cook (2012) recently suggested the Internet has also facilitated the spread of misinformation. They note that “with the development of Web 2.0 Internet users have moved from being passive consumers

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of information to actively creating content on Web sites such as Twitter and YouTube or blogs” (p. 110).

Research on factors that predict false beliefs or misconceptions is sparse. Taylor and Kowalski (2004) found many students did not remember exactly how the misinformation was learned and others cited personal experience, media sources, previous coursework, or reading. They found information based on media sources was more likely to be incorrect than that from classroom learning or personal experience. Taylor and Kowalski also note that interpretation of the sources is complicated due to the self-report nature of the research and the fact that many participants do not remember where the misconception came from. Landau and Bavaria (2003) found 38% of students reported they had acquired their false beliefs through a psychology course or teacher.

Furnham, Callahan, and Rawles (2003) examined factors that predicted knowledge of general psychology. Variables evaluated included demographics (sex, age, and education), political and religious beliefs, interest in/experience with psychology, and belief in psychology as a science. The authors measured interest in/experience with psychology with four questions that included, “Have you ever read any serious books on psychology?”; “Have you ever visited a psychologist/psychotherapist?”; “Would you say you were especially interested in psychology?”; “Do you believe psychology is a science?”. A regression analysis revealed that reading serious books in psychology and a belief in psychology as a science were the best predictors of accurate knowledge of general psychology topics.

It is difficult to quantify the full impact of psychological misconceptions. One negative consequence may be that misconceptions become obstacles to learning by impeding the acquisition of new and accurate knowledge (Hammer, 1996; Lilienfeld, 2010b). The distinguished philosopher of science Sir Karl Popper (1963) commented early on that teaching science should begin with myths, and with the criticism of myths. As Lilienfeld (2010b) notes, “failure to address misconceptions explicitly in coursework often leaves such misconceptions unscathed” (p. 36). Several studies suggest it requires more of teachers than merely informing students about misconceptions. Rather, informing students why a belief is wrong, followed up by scientific evidence backing the refutation, is necessary (Kowalski & Taylor, 2009; Schwarz, Sanna, Skurnik, & Yoon, 2007; Winer, Cottrell, Gregg, Fournier, & Bica, 2002). Holmes and Beins (2009) have shown that undergraduate psychology majors have a decreased tendency to view psychology as a science over time.

From a practical standpoint, individuals who harbor misconceptions may unknowingly make decisions or life choices that are not advisable (Lilienfeld, 2010b; Lilienfeld et al., 2010). For example, people who believe in the myth that opposites attract may become frustrated looking for a “match” that is unlikely to be successful. As Lilienfeld (2010b) pointed out, individuals may dismiss serious situations such as suicidal talk from a seemingly non-depressed person falsely believing that only deeply depressed individuals commit suicide.

Several criticisms have been made of the way that tests of misconceptions are constructed. Gardner and Dalsing (1986) noted that earlier versions of misconception tests often presented items in a dichotomous true/false format, with no option for respondents to state that they did not know the answer or that they had no opinion. Without the option to choose I don’t know/no opinion, respondents will be forced to guess either true or false and the test may not provide an accurate measure of belief in misconceptions. When given the option of answering “I don’t know”, Gardner and Dalsing found participants selected this choice 12.2% of the time. A dichotomous true/false format also does not have the capability of measuring the degree or strength of a particular belief. They argued that a Likert type scale would represent degrees of belief to better reflect how ingrained a misconception may be. Landau and Bavaria (2003) found students often hold inaccurate psychological beliefs with greater confidence than they do accurate psychological beliefs. Ruble

(1986) noted that issues in psychology are so complex that a single statement presented as either true or false fails to discriminate between misconceptions and answers resulting from guessing. Brown (1984) and Ruble (1986) observed that statements of misconceptions are frequently written ambiguously, based on generalizations and/or findings hotly debated by psychologists, and are frequently presented without qualifiers. Finally, investigators often do not report psychometric properties of misconception tests.

In this study, we developed a contemporary test of misconceptions in psychology based on what Lilienfeld et al. (2010) describe as great myths of popular psychology in eleven topic areas. We examined the role of several potential predictor variables on beliefs in these misconceptions. Predictors included demographics, year in college, academic discipline or major, number of psychology classes taken, current grade point average, television viewing habits, internet usage, sources of news, types of books read most often, and interest in/experience with psychology. Interest in/experience with psychology was assessed using four questions developed by Furnham et al. (2003). The questions focused on exposure to serious books in psychology, experience in therapy, interest in psychology, and belief in psychology as a science. We measured misconceptions in 11 topic areas of psychology, as outlined by Lilienfeld et al. (2010). A secondary purpose of the study was to evaluate test construction by examining whether the wording of a statement as true or false is related to the frequency with which it is held as a misconception as well as the frequency with which participants utilized “don’t know” responses.

1. Method

1.1. Participants

A total of 137 undergraduate students from the University of Colorado Denver and Metropolitan State College of Denver participated in the study. There were 75 females and 62 males with a mean age of 21.08 ($SD=3.88$). Mean years in college was 1.96 ($SD=1.18$), average number of psychology classes taken was 1.72 ($SD=.79$), average reported GPA was 3.24 ($SD=.48$), mean hours of television watched per day was 2.06 ($SD=1.42$), and average hours spent per day on the internet was 3.37 ($SD=2.08$). College majors fell into the following broad discipline areas: natural sciences (28%), engineering and aviation aerospace (6%), behavioral social sciences and humanities (36%), business (12%) and undecided/undeclared (10%). Approximately 9% of participants did not report a major.

1.2. Measure

We developed a 55-item questionnaire directly from popular psychology myths in 11 topic areas outlined by Lilienfeld et al. (2010). Each topic area comprised five questions. Topic areas were as follows: 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. We worded approximately one-half of the questions as true statements and one-half as false statements. Responses were coded on a five-item Likert type scale with options of “completely false”, “mostly false”, “partly false and partly true”, “mostly true”, “completely true”. Respondents were also able to select “don’t know” for each question. The questionnaire is illustrated in Table 1.

1.3. Procedure

We gave the questionnaire to students enrolled in Introduction to Psychology courses at the University of Colorado Denver and Metropolitan State College of Denver during regular class time. We told

Table 1

Misconceptions in psychology test.

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.

	Mean misconception (larger mean reflects higher misconception)
<i>Brain and behavior</i>	
1. Most people use only about 10% of their brain power.	3.3
2. Visual perceptions are accompanied by tiny emissions from the eyes.	3.4
3. Adult humans can grow new brain cells.*	3.3
4. Almost all color-blind people can see at least some colors.*	2.3
5. Some people are exclusively left-brained while others are right-brained.	3.5
<i>Development and aging</i>	
6. People become increasingly satisfied with their lives in old age.*	2.8
7. Most adopted children are psychologically healthy.*	2.8
8. Married couples enjoy more marital satisfaction after they have children.	2.8
9. Infants establish attachment bonds only to their mothers.	2.5
10. A small percentage of the elderly live in nursing homes.*	3.1
<i>Memory</i>	
11. It is not common for individuals to repress the memories of traumatic experiences.*	3.4
12. People with amnesia can still recall some details of their earlier lives.*	2.4
13. The memory of everything we've experienced is stored permanently in our brains, even if we can't access all of it.	3.8
14. With effort, we can remember events back to the time of our birth.	2.0
15. Some people have true photographic memories.	4.2
<i>Intelligence and learning</i>	
16. IQ scores are relatively unstable in childhood.*	2.6
17. There is a modest correlation between brain size and IQ in humans.*	3.4
18. As a general rule, students typically recall only 10% of what they read.	3.2
19. Irregularly provided feedback best promotes long-term learning.*	3.2
20. Negative reinforcement is a type of punishment.	3.2
<i>Consciousness</i>	
21. Hearing material while we are asleep (sleep learning) can be an effective aid to learning.	3.0
22. Hypnotized people are aware of their surroundings and can recall the details of conversations overheard during hypnosis.*	3.1
23. It is impossible to lie under hypnosis.	2.4
24. Virtually all people dream.*	1.6
25. Our brains rest during sleep.	2.5
<i>Emotion and motivation</i>	
26. The polygraph (lie detector) test is not an accurate means of detecting dishonesty.*	2.7
27. Ulcers are caused primarily by stress.	3.5
28. Women are no better than men at accurately guessing the feelings of others.*	3.3
29. Unfamiliarity breeds contempt: We dislike things we have less exposure to.*	2.2
30. Extreme fear can turn our hair white.	2.2
<i>Social psychology</i>	
31. We are most romantically attracted to people who are similar to us.*	2.5
32. The more people present at an emergency, the greater the chance that someone will intervene.	2.6

Table 1 (continued)

	Mean misconception (larger mean reflects higher misconception)
<i>Social psychology</i>	
33. Expressing anger directly toward another person or object makes us more aggressive.*	2.6
34. Groups tend to make less extreme decisions than individuals.	2.8
35. The best way to change someone's attitude is to give them a large reward to do so.	3.2
<i>Personality</i>	
36. We cannot tell a person's personality by merely looking at their handwriting.*	2.5
37. Knowing a person's astrological sign predicts their personality traits at better than chance levels.	2.2
38. Most people who were physically abused as children do not go on to become abusers themselves.*	3.2
39. Most children survive the divorce of their parents without much, if any, long-term psychological damage.*	3.1
40. Obese people are more cheerful ("jolly") than thin people.	1.9
<i>Mental illness</i>	
41. Only deeply depressed people commit suicide.	2.2
42. People with schizophrenia do not have multiple personalities.*	2.9
43. There has recently been a massive epidemic of childhood autism.	3.3
44. All clinically depressed people suffer from extreme sadness.	3.3
45. Most people who experience severe trauma, as in military combat, do not develop posttraumatic stress disorder (PTSD).*	3.2
<i>Psychology and law</i>	
46. The rates of serial killers are no higher among Whites than other racial groups.*	2.9
47. Homicide is more common than suicide.	3.3
48. Most rapes are committed by strangers.	2.4
49. The words "insanity" and "sanity" are purely legal not psychological terms.*	2.2
50. Most people that plead insanity are not faking mental illness.*	3.2
<i>Psychological treatment</i>	
51. More experienced therapists are generally no more effective than those with little experience.*	3.6
52. Most psychotherapy involves a couch and exploring one's early past.	2.6
53. Antidepressants are much more effective than psychotherapy for treating depression.	2.6
54. Taking a placebo (i.e. sugar pill) can change brain functioning and chemistry.*	3.1
55. Electroconvulsive therapy is rarely administered today.	3.8

* Indicates true statements which are reverse scored.

students that the purpose of the study was to learn about undergraduate beliefs regarding common topics in psychology, and that participation was strictly voluntary. Students did not receive compensation for participation. The questionnaire took approximately 10 min to complete.

2. Results

Data identified as outliers on average levels of misconceptions in each of the 11 topic areas (exceeding ±2 Z scores) were deleted and replaced by the average of the remaining scores. Subsequently,

an average of six scores in each misconception topic was deleted and mean values were substituted. We reverse scored items written as true statements, so that higher scores represented stronger beliefs in the misconceptions. The average overall misconception rating was $M = 2.9$ ($SD = .29$), wherein a rating of one represents a belief in the total falsity of a misconception and five represents a belief that a misconception is completely true. Table 1 shows the average misconception level for each question. There were no significant differences in scores between the two educational institutions used in the study. The average rating of 2.9 indicated that respondents felt that most of the misconceptions were close to “partly false and partly true”, represented by a score of 3 on the scale. The small standard deviation reveals that most respondents did not believe in the complete truth or falsity of most of the misconceptions.

A three-way ANOVA examined differences between misconception levels between men and women, discipline areas, and psychological topic areas. Table 2 lists the average level of misconceptions for each of the 11 topic areas, ranging from highest to lowest. The ANOVA revealed a significant difference between the 11 topic areas ($F(10, 1127) = 9.74, p < .00001$). An effect size of partial $\eta^2 = .08$ was determined, approximating Tabachnick and Fidell's (2007) definition of .09 as a medium effect size. Although the ANOVA also revealed a significant gender difference as well as a significant interaction between gender and psychological topic areas, the effect sizes were so small that meaningful comparisons are not possible. There was no significant difference between participants in the five discipline areas nor were any of the other interaction terms significant.

A multiple regression examined possible predictors of misconceptions. We screened potential predictor variables to isolate important variables in the final regression model. The initial analysis identified gender, age, TV viewing habits, and internet use as potential predictor variables. A multiple regression (R^2 model = .09, Adj. $R^2 = .06$) revealed that the only significant predictor was whether participants were men or women, $\beta = -.10, t(124) = -2.06, p < .05$; Cohen's $f^2 = .10$. As was the case in the ANOVA, the small effect size and amount of variation explained by the gender variable indicates it is of limited meaningfulness as a predictor.

We explored the role that news sources play in misconceptions, including the frequency with which respondents reported obtaining their news from the newspaper, internet, news magazines, celebrity magazines, and TV. After screening, news magazines, celebrity magazines, and TV contributed most to the R -Squared model, ($R^2 = .06$, Adj. $R^2 = .04$). A multiple regression found only news magazines to be a significant predictor, $\beta = -.11, t(124) = -2.31, p < .03$; Cohen's $f^2 = .06$. Frequent reading of news magazines such as *Time* and *Newsweek* predicts lower scores on the misconception test, although the amount of variance explained and effect size is again so small as to limit conclusions.

Table 2

Average level of misconceptions in 11 topic areas in psychology on a five point scale where 1 = completely false and 5 = completely true. A rating of 3 = partly false and partly true. Higher mean values reflect a higher level of misconception.

Topic	Level of misconception
Psychological treatment	3.1
Memory	3.1
Intelligence and learning	3.1
Brain and behavior	3.0
Mental illness	2.8
Emotion and motivation	2.8
Psychology and the law	2.8
Development and aging	2.8
Social psychology	2.7
Personality	2.5
Consciousness	2.5

A similar analysis compared the frequency of reading fiction, non-fiction, and self-help books as separate predictors. Type of books read was not a significant predictor of scores on the misconception test.

With respect to test construction, the test included a response option of “don't know”, as recommended by Gardner and Dalsing (1986). Respondents in this study answered “don't know” 13.1% of the time, a percentage similar to the 12.2% reported previously by Gardner and Dalsing. These findings support the recommendation that misconceptions tests avoid statements written in a strictly true/false format. Rather, items should measure the strength of the misconception and include an option regarding whether the respondent has any knowledge or belief regarding the statement.

In order to determine whether the wording of statements as true or false influenced endorsement of misconceptions, a t -test compared the average misconception score with items presented as a true statement versus those presented as a false statement. There was no significant difference between the true and false formats. Finally, the internal consistency of the scale, found by computing the average inter-item correlation, resulted in Cronbach's alpha (α) = .85, a value higher than the .80 that Carmines (1990) recommends as a minimum value.

3. Discussion

These findings reveal that most students in this sample hold the psychology misconceptions presented to be at least partially true. Only about 13% of respondents reported no opinion about the truth or falsity of the misconceptions. The relatively small variation in respondents' scores indicates that 75% of those who expressed an opinion rated the statements between a narrow range of 2.7 and 3.1 on the five-point scale where 3 represents a “partly false and partly true” response. Although the mean rating is tilted slightly toward recognition of the falsity of the statements, it is clear that most students believe that there is at least some truth to these misconceptions. This may be a reflection of the observation by Lilienfeld (2010b) that some psychological myths or misconceptions are not entirely false. Rather, they are an exaggeration of statements that contain “a kernel of truth.” A notable limitation of the questionnaire was that only five statements were used to measure misconceptions in each topic area. Consequently, the questions are likely not representative of the overall level of misconceptions students hold in each topic area. Furthermore, the authors of the Lilienfeld et al. (2010) book did not intend to provide representative coverage of psychological myths within topic areas (J. Ruscio, personal communication, May 5, 2012).

The significant difference among the 11 psychological topic areas may reflect the differences of media exposure these topics receive, although the effect size for the differences between topics was only moderate. Beins (2008) has observed that inaccurate portrayals of mental illness and treatment occur frequently in the entertainment and news media. Mental illness and treatment were among the topics with the highest misconceptions, ranking first and fifth of the eleven topics covered in this survey. The three topic areas with the lowest level of misconception, including social psychology, personality, and consciousness seemingly receive less media attention.

Some studies have found a relationship between credit hours taken and misconceptions, with misconceptions decreasing as college credit hours in psychology increase (Gardner & Dalsing, 1986), a finding not replicated here. This is likely due to the limited number of credit hours completed in psychology courses by students in the present sample. For possibly the same reason, the number of college credit hours taken was also not a significant predictor. Future studies should examine a less homogenous sample.

Although gender differences were statistically significant, the absolute magnitude of the difference and the effect size are so small as to render them practically meaningless. Findings regarding gender

differences in this area have been sparse and inconsistent. Examination of possible differences between men and women in the prevalence of psychology misconceptions may deserve future attention.

Delineating which variables predict beliefs in misconceptions in previous studies has been difficult and remained elusive in this study. Many of the 10 sources of misconceptions posited by Lilienfeld (2010b), such as word of mouth, a desire for easy answers and quick fixes, and misleading film and media portrayals are difficult if not impossible to measure. Several predictor variables we deemed likely related to misconceptions at the beginning of the study proved not to be. This may be due to the relatively small variability in these variables in the relatively homogenous sample of introductory psychology students. With respect to media influences, only the frequency of reading news magazines predicted a lower level of misconceptions in this sample. News magazines often cover topics related to psychology and it appears that, to a limited extent, frequent reading of such material predicted a lower level of misconceptions in this sample. This choice of reading material may also reflect a tendency to seek information from more trustworthy sources of information. It also suggests that students who think critically might be more likely to gravitate to such information sources. We did not replicate the findings by Furnham et al. (2003) that reading serious books in psychology and a belief in psychology as a science were predictors of accurate knowledge in general psychology topics. Considering the few predictors that proved significant as well as the small proportion of variance explained, it will be necessary to develop more sensitive measures of many of the sources posited by Lilienfeld. The need to explore other perhaps less obvious antecedents will also be necessary.

From a methodological standpoint, our study supports the construction of misconception scales that allow for a “don’t know” option and measure misconception strength with a Likert-type scale as opposed to a dichotomous true/false scale. Interestingly, it appears irrelevant whether misconceptions are presented as a true or false statement. However, it is possible that wording a statement as true and as false will not give equivalent response patterns. For example, a student may believe that most people use only 10% of their brain; but to phrase it in “true” language that most people use more than 10% of their brain may change an individual’s tendency to evaluate it as true or false. Furthermore, we did not investigate equivalence in scores for the same items phrased true or false, which future studies should examine.

The misconception scale developed in this study is an instrument with good internal consistency. It discriminates misconceptions between many of the major subfields in psychology. Since the scale is constructed only from the 50 popular myths described in the Lilienfeld et al. (2010) book, it cannot be assumed to provide representative coverage of myths within psychological topic areas. Future scales striving to construct a more representative measure of contemporary myths in psychology might wish to consider a broader range of such myths. The scale does encompass several contemporary topics not covered in earlier misconception scales and should prove beneficial to educators and other researchers interested in exploring this topic further. The scale could serve as a useful pedagogical tool to identify psychological misconceptions held by students in the introductory course or at more advanced levels of instruction. The importance of identifying such misconceptions and presenting scientific evidence that refutes these misconceptions is well documented.

References

- APA Presidential Task Force on Evidence-Based Practice (2006). Evidence-based practice in psychology. *American Psychologist*, 66, 271–285.
- Beins, B. (2008). Why we believe: Fostering critical thought and scientific literacy in research methods. In D. S. Dunn, J. S. Halonen, & R. A. Smith (Eds.), *Teaching critical thinking in psychology: A handbook of best practices* (pp. 199–210). Malden, MA: Wiley-Blackwell.
- Brown, L. T. (1984). Misconceptions about psychology aren't always what they seem. *Teaching of Psychology*, 11, 75–78.
- Carmines, E. G. (1990). The statistical analysis of overidentified linear recursive models. *Quality and Quantity*, 24, 65–85.
- Della Sala, S. (Ed.). (1999). *Mind myths: Exploring popular assumptions about the mind and brain*. Chichester, England: Wiley.
- Della Sala, S. (Ed.). (2007). *Tall tales about the mind and brain*. Oxford, England: Oxford University Press.
- Furnham, A. (1993). A comparison between psychology and non-psychology students' misperceptions of the subject. *Journal of Social Behavior and Personality*, 8, 311–322.
- Furnham, A., Callahan, I., & Rawles, R. (2003). Adults' knowledge of general psychology. *European Psychologist*, 8(2), 101–116.
- Gardner, R. M., & Dalsing, S. (1986). Misconceptions about psychology among college students. *Teaching of Psychology*, 13, 32–34.
- Gardner, R. M., & Hund, R. M. (1983). Misconceptions of psychology among academicians. *Teaching of Psychology*, 10, 20–22.
- Hammer, D. (1996). More than misconceptions: Multiple perspectives on student knowledge and reasoning, and an appropriate role for education research. *American Journal of Physics*, 64(10), 1316–1325.
- Holmes, J. D., & Beins, B. C. (2009). Psychology is a science: At least some students think so. *Teaching of Psychology*, 36, 5–11.
- Kowalski, P., & Taylor, A. K. (2009). The effect of refuting misconceptions in the introductory psychology class. *Teaching of Psychology*, 36, 153–159.
- Landau, J. D., & Bavaria, A. J. (2003). Does deliberate source monitoring reduce students' misconceptions about psychology? *Teaching of Psychology*, 30, 311–314.
- Lewandowsky, S., Decker, U. K. H., Seifert, C. M., Schwarz, N., & Cook, J. (2012). Misinformation and its correction: Continued influence and successful debiasing. *Psychological Science in the Public Interest*, 13, 106–131.
- Lilienfeld, S. O. (2010a). Confronting psychological misconceptions in the classroom: Challenges and rewards. *APS Observer*, 23(1), 36–39.
- Lilienfeld, S. O. (2010b). Can psychology become a science? *Personality and Individual Differences*, 49, 281–288.
- Lilienfeld, S. O., Lynn, S. J., Ruscio, J., & Beyerstein, B. L. (2010). *Great myths of popular psychology: Shattering widespread misconceptions about human behavior*. Chichester, England: Wiley-Blackwell.
- Lochead, J., & Mestre, J. (1988). From words to algebra: Mending misconceptions. In A. Coxford, & A. Schulte (Eds.), *The ideas of algebra K–12* (pp. 127–135). Reston, VA: National Council of Teachers of Mathematics.
- McCloskey, M. (1983). Naive theories of motion. In D. Gentner, & A. L. Stevens (Eds.), *Mental models* (pp. 299–324). Hillsdale, NJ: Erlbaum.
- McCutcheon, L. E., Furnham, A., & Davis, G. (1993). A cross-national comparison of students' misconceptions about psychology. *Psychological Reports*, 72, 243–247.
- McKeachie, W. J. (1960). Changes in scores on the Northwestern Misconceptions Test in six elementary psychology courses. *Journal of Educational Psychology*, 51, 240–244.
- Mercer, J. (2010). *Child development: Myths and misunderstandings*. New York: Sage.
- Michael, J. (2002). Misconceptions – What students think they know. *Advances in Physiology Education*, 26, 5–6.
- Ozmen, H. (2004). Some student misconceptions in chemistry: A literature review of chemical bonding. *Journal of Science Education and Technology*, 13, 147–159.
- Popper, K. R. (1963). *Conjectures and refutations*. London: Routledge and Keagan Paul.
- Ruble, R. (1986). Ambiguous psychological misconceptions. *Teaching of Psychology*, 13, 34–36.
- Schwarz, N., Sanna, L., Skurnik, I., & Yoon, C. (2007). Metacognitive experiences and the intricacies of setting people straight: Implications for debiasing and public information campaigns. *Advances in Experimental Social Psychology*, 39, 127–161.
- Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th edition). Boston, MA: Pearson Education, Inc.
- Taylor, A. K., & Kowalski, P. (2004). Naive psychological science: The prevalence, strength, and sources of misconceptions. *Psychological Record*, 54, 15–25.
- Vaughn, E. D. (1977). Misconceptions about psychology among introductory college students. *Teaching of Psychology*, 4, 38–41.
- Winer, G. A., Cottrell, J. E., Gregg, V. R., Fournier, J. S., & Bica, L. A. (2002). Fundamentally misunderstanding visual perception: Adults' belief in visual emissions. *American Psychologist*, 57, 417–424.