

CHAPTER TWENTY-TWO

ATTITUDES TOWARD PSYCHOLOGY AS A SCIENCE AND THE PERSISTENCE OF PSYCHOLOGICAL MISCONCEPTIONS IN PSYCHOLOGY UNDERGRADUATES

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Internationally, curricular guidelines for psychology recognise the scientific nature of the discipline, a position that is sometimes at odds with students' expectations and interests. Students' appreciation of psychology as a science increases with experience of the subject. However, students bring to the study of psychology a range of popular psychological misconceptions that often remain intact through their studies. The study described in this chapter examined endorsement of psychology-related misconceptions and anti-scientific views in students at different stages in their degree studies, as well as attitude towards psychology as a science.

Three groups of undergraduate students completed measures of false beliefs approximately midway through the academic year. One group had studied psychology for four months ($n=83$), another for 18 months ($n=55$), and the third for 30 months ($n=40$). The results showed greater appreciation of psychology as a science by those with more experience of the subject, but no relationship between appreciation of psychology as a science and endorsement of misconceptions. Furthermore, some common misconceptions continued to be endorsed even after significant experience of psychology. This suggests that while students agree that psychology is a science, the core scientific values that would allow them to critically assess the basis for their own beliefs have not yet been fully adopted. These findings concur with research showing that such erroneous beliefs are resistant to change and may need to be challenged and refuted directly by teachers.

Brewer et al. (1993) noted that "the fundamental goal of education in psychology, from which all others follow, is to teach students to think as scientists about behaviour" (p.169). The ability to think about behaviour in a scientific manner requires the appreciation of psychology as a scientific discipline and the adoption of its disciplinary beliefs and values. Yet, graduating students who have completed their undergraduate training in psychology do not always appear to think as scientists about human behaviour (Amsel, 2009a).

In a scientific discipline, learning is conceptualised as a rational activity, "concerned with ideas, their structure and evidence for them" (Posner, Strike, Hewson & Gertzog, 1982, p.212). Learning involves weighing up evidence so as to make a judgement about a particular idea – the ideas one brings to the learning context are therefore influential. Students attracted to psychology as a course choice often bring to their studies a set of beliefs that are not in keeping with those of the discipline (Holmes & Beins, 2009). It is not unusual for students entering a psychology course to harbour a range of misconceptions affecting core beliefs about the discipline (e.g., "psychology is just common sense") as well as specific knowledge areas (e.g. "a good hypnotist can make people behave in ways they would not otherwise"). Because psychology's subject matter considers issues of everyday experience that are subject to much discussion by the wider public and misrepresentation in the popular media (e.g., Lilienfeld, Lynn, Ruscio, & Beyerstein, 2010), the discipline is particularly vulnerable to such misconceptions. As Ewing et al. (2010, p.87), put it, "psychology's problem is that it is interesting and imminently accessible to any armchair theorist. Everyone is an 'expert' in psychology." Teaching psychology requires challenging this belief.

Students come to psychology confident that they already possess some objective knowledge about its subject matter, the source of this knowledge being 'common sense' or 'conventional wisdom'. The common-sense account of mind and behaviour, based on anecdote and subjective experience, is referred to as *folk psychology* (e.g. Dennett, 1971; Premack & Woodruff, 1978) and it is the antithesis of psychological science. As teachers of psychology, we find ourselves having to counter the idea that

psychology is 'common sense' and to challenge students' existing, deeply embedded and resistant ideas. The problem with common sense, as Lindgren and Harvey (1981) note, is that it lulls us into a false sense of security so that we overestimate our understanding of human behaviour.

Much research has by now established that students bring misconceptions to their first psychology course (McKeachie, 1960; Vaughan, 1977; Gardner & Dalsing, 1986). The misconceptions that students of psychology harbour match those of the wider public. Claims such as "we only use 10% of our brains", "listening to Mozart increases babies' intelligence" and "subliminal messages can persuade people to buy products" appear, in one form or another, with alarming regularity in the popular media. Others (such as "a full moon causes bad behaviour" or "opposites attract") are deeply ingrained in 'folk wisdom'. In discussing the '10% of our brain' myth, Stanovich (2010) quotes columnist Robert Samuelson's (1994) term 'psycho-fact', referring to "beliefs that, though not supported by hard evidence, are taken as real because their constant repetition changes the way we experience life." Samuelson was writing about the availability heuristic and risk perception (see Tversky & Kahneman, 1973), but the term might be usefully employed more broadly to refer to misconceptions about psychological issues that are often repeated and come to be taken as fact, creating a 'psychomythology' that is resistant to counterevidence. Some of these 'psycho-myths' share the contagion of urban legends and chain letters, taking on the status of memes (Dawkins, 1989, p.186; Blackmore, 1999; Lynch, 1996).

Misconceptions affect learning in other disciplines, such as biology (e.g., Munson, 1994), physics (Clement, 1982) and chemistry, (Barker & Millar, 1999). Hammer (1996), writing on physics teaching, notes four features of misconceptions that affect learning of a discipline: misconceptions are strongly held and stable cognitive structures; they differ from expert conceptions; they affect a student's understanding of scientific explanations; and they need to be eradicated if a student is to attain an expert understanding of the discipline. This is consistent with accounts of learning that highlight conceptual change (e.g., Posner et al., 1982). If central concepts of new learning are to replace current beliefs, those existing beliefs must be seen as unsatisfactory. In the case of psychology, there is much to be 'unlearned' and teaching that elicits cognitive conflict may be necessary. Amsel (2009b) notes the need to go beyond knowledge transmission in teaching psychology and advocates *metainstruction*, teaching that aims to convey psychology's beliefs and values and to transform the student's identity as scientific students of behaviour.

Teachers of psychology have an ethical responsibility to counter misinformation and misconceptions about the discipline (Ewing et al., 2010). Teachers are cognizant of this duty, yet students completing their undergraduate study of psychology often leave with their misconceptions intact (e.g., McKeachie, 1960; Taylor & Kowalski, 2004; Vaughan, 1977). Our study set out to examine students' beliefs about psychology at varying stages through their degree studies. We wanted to establish whether the appreciation of psychology as a scientific discipline increases with experience of the subject and whether misconceptions and erroneous beliefs about psychological phenomena change. If students come to appreciate psychology as a science, consistent with conceptual change approaches, one might hypothesise that they engage in more evaluation of their previously held ideas (some of which are misconceptions) and are motivated to change those that prove unsatisfactory. However, it may be the case that such beliefs are resistant to change in spite of a growing appreciation of psychology as a scientific endeavour.

In order to address this question, we devised a set of misconceptions based on the existing literature which was administered along with the *Psychology as Science Scale* (PAS; Friedrich, 1996) and the *Revised Paranormal Beliefs Scale* (R-PBS; Tobacyk, 2004) as a measure of students' anti-scientific beliefs. The PAS scale has been used in many studies and is a valid and reliable measure of belief about the scientific nature of the discipline which has been shown to predict psychology students' examination performance (Friedrich, 1996). Several studies have shown that the tendency to see psychology as a science, as measured by PAS, increases with experience of psychology (Amsel, Baird, & Ashley, in press; Friedrich, 1996; Holmes & Beins, 2009).

The PAS contains 15 statements about psychology which students rate from 1 (strongly disagree) to 7 (strongly agree). Items include statements such as "research conducted in controlled laboratory settings is essential for understanding everyday behaviour" and "psychological research can enable us to anticipate people's behaviour with a high degree of accuracy". It directly addresses beliefs that must be adopted if someone is to become a scientific psychologist: that behaviour is predictable, that the causes of behaviour are not always subject to conscious awareness and that these can be measured objectively (Amsel, 2009a) and as such assesses core beliefs in psychology (Amsel, Johnston, Alvarado, Kettering, Rankin & Ward, 2009).

The *Revised Paranormal Beliefs Scale* (R-PBS; Tobacyk, 2004) provides a measure of self-reported paranormal and religious beliefs. Respondents rate the degree of belief on a seven point scale for 26

items. Tobacyk (2004) defines paranormal phenomena as “those that, if genuine, would violate basic limiting principles of science” (p.94); as such, belief in these phenomena is at odds with scientific thinking and scores on the R-PBS are treated here as a measure of ‘anti-scientific thinking’. For example, the scale includes statements such as: “psychokinesis, the movement of objects through psychic powers, does exist”; “some individuals are able to levitate (lift) objects through mental forces”; “astrology is a way to accurately predict the future”; “if you break a mirror, you will have bad luck”. Lange, Irwin and Houran (2000) produced a psychometrically improved version of the R-PBS which identifies two unidimensional clusters and avoids significant differential item functioning for age or gender. Scores using Lange et al.’s sub-scales, New Age Philosophy and Traditional Paranormal Beliefs, are also reported in the current study.

The R-PBS is included here as a measure of anti-scientific thinking and therefore it was hypothesised that scores on its paranormal subscales would be associated with acceptance of psychology misconceptions. Studies have found that belief in paranormal phenomena is associated with lower performance on reasoning tasks (Hergovich & Arendasy, 2005; Wierzbicki, 1985) and on some measures of critical thinking (e.g., Gray & Mill, 1990; but see also Hergovich & Arendasy, 2005). Tobacyk and Milford (1983) reported correlations between the superstition and spiritualism subscales and a measure of irrational thinking.

We devised a list of twenty psychology misconceptions which were presented along with six filler items. The list included items such as “we only use 10% of our brains”, “listening to Mozart increases babies’ intelligence”, and “behaviour is influenced by moon phases”. We defined misconceptions as psychological claims that are not supported by psychological research (see Amsel, Baird & Ashley, in press; Gardner & Dalsing, 1986; Taylor & Kowalski, 2004). These items were selected using a literature search on psychology misconceptions and we avoided items identified as ambiguous in previous studies (e.g., Brown, 1984; Gardner & Dalsing, 1986; Griggs & Ransdell, 1987; Ruble, 1986). The relatively small number of misconceptions reflects the difficulty in identifying reliable misconceptions across studies; Griggs and Ransdell (1987), for example, found only 15 across several studies reviewed (see also Brown, 1983). By allowing students to rate on a 7-point scale the degree to which they agreed with each statement, we aimed to avoid problems associated with limiting answers with a true/false format (e.g., see Gardner & Dalsing, 1986). The use of a 7-point scale also ensured that the response format was the same on the three measures used.

If students come to appreciate psychology as a science as their experience of the discipline grows, we would expect to find that students with more psychology experience produce greater PAS scores. If higher PAS scores are associated with lower rates of misconceptions and anti-scientific thinking, it would suggest that students are applying scientific thinking to a range of psychological phenomena. However, it may be that students can accept the scientific approach of the discipline without allowing their misconceptions to be undermined; in this case scores on the PAS may not be associated with performance on the misconceptions measure. A secondary aim of the study was to identify the most popular misconceptions, and affected knowledge areas, and thereby to identify areas of the psychology curriculum that might require additional attention or a focused pedagogical approach.

Method

Participants

The sample consisted of 178 undergraduate students of psychology. Group 1 (n = 83) had studied psychology for four months. Twenty were men and 63 were women. Ages ranged from 18 to 47 years, with a median age of 19 years. Group 2 (n = 55) had studied psychology for 18 months; 14 were men and 36 were women; 5 did not state their gender. The age range for this group was from 18 to 55 years, with a median age of 20 years. Group 3 consisted of 40 students approaching their final examinations, having studied psychology for 30 months. Seven were men and 29 were women; 4 did not report gender. The age range for this group was 19 to 48 years, with a median age of 21 years. Students volunteered to participate in class, and did not receive course credit for participation.

Measures

Three measures were used: Friedrich’s (1996) *Psychology as Science* (PAS) scale, the *Revised Paranormal Beliefs Scale* (Tobacyk, 2004) and a psychology ‘misconceptions’ questionnaire.

The PAS scale is designed to assess the degree to which psychology is viewed as similar to the natural sciences, that is “as deriving authority from an empirical research base addressing lawful, predictable phenomena” (Friedrich, 1996, p.12). The PAS contains 15 items such as “it’s just as

important for psychology students to do experiments as it is for students of chemistry or biology” and “research conducted in controlled laboratory settings is essential for understanding everyday behaviour”. Respondents rate each statement on a seven point scale from 1 (strongly disagree) to 7 (strongly agree). Seven items are reverse scored and 8 items are positive-scored; five filler items are included to obscure the purpose of the scale. Friedrich (1996) reported coefficient alphas in the range of .7 to .8 across several studies and a test-retest stability of $r = .76$. The PAS instructs respondents to rate the degree to which they agree or disagree with statements that “represent an opinion about psychology”. Respondents are told “you will probably agree with some of the statements and disagree with others; there are no correct or incorrect answers”.

The *Revised Paranormal Beliefs Scale* (R-PBS; Tobacyk, 2004) provides a measure of self-reported paranormal and religious beliefs and consists of seven subscales: traditional religious belief; psi; witchcraft; superstition; spiritualism; extraordinary life forms; and precognition. Respondents rate the degree of belief on a seven point scale (1 = strongly disagree, 7 = strongly agree) for 26 items. The paranormal beliefs were of interest here, as belief in these phenomena is at odds with scientific thinking. For example, endorsement of the psi items involves agreeing that “psychokinesis, the movement of objects through psychic powers, does exist” and “some individuals are able to levitate (lift) objects through mental forces”. The precognition items include statements such as “astrology is a way to accurately predict the future”. The superstition items include “black cats can bring bad luck” and “if you break a mirror, you will have bad luck”. Students who have adopted the core values and beliefs of psychology as a scientific discipline would not be expected to agree with such items. We made one change to the R-PBS: the item “the abominable snowman of Tibet exists” was changed to “the yeti/ bigfoot exists” as piloting showed that some students were not familiar with the ‘abominable snowman’ but produced the term ‘bigfoot’ on explanation of the reference. The instructions of the R-PBS tell respondents that “there are no right or wrong answers. This is a sample of your own beliefs and attitudes.”

Lange et al. (2000) produced a psychometrically improved version of the R-PBS which identifies two unidimensional clusters and avoids significant differential item functioning for age or gender. Their method produces two subscales. New Age Philosophy, consisting of 11 items, is associated with ‘paranormal abilities’ (reincarnation, altered states, astrology, and precognition). Traditional Paranormal Beliefs, consisting of five items, is associated with traditional supernatural concepts and contains items on traditional religious concepts (hell, devil) as well as witchcraft.

In devising our psychology misconceptions questionnaire, we adapted items from several published sources (e.g., Griggs & Ransdell, 1987; Kowalski & Kujawski Taylor, 2009; Lilienfeld, Lynn, Ruscio & Beyerstein, 2010), selecting items that are relatively pervasive misconceptions held by the public about psychological phenomena. We used a seven point scale on which students indicated the degree to which they disagreed (1) or agreed (7) with 26 statements, 20 of which were misconceptions. Items included “we only use 10% of our brains”, “listening to Mozart increases babies’ intelligence”, “subliminal messages can persuade people to buy products”, “to change behaviour we must change attitudes” and “behaviour is influenced by moon phases”. Our instructions told participants that they would read a set of statements that “represent an opinion about psychological phenomena” and that they would “probably agree with some of the statements and disagree with others”.

Procedure

Participants were assessed approximately midway through the academic year. The questionnaires were distributed in class. Students provided demographic information on a cover sheet, and completed the three scales. No identifying information was recorded. Students were reminded to read each set of instructions before completing the questionnaire. On all three measures, participants rated the statements using a 7-point scale (1 = strongly disagree, 7 = strongly agree, with a neutral rating or 4, ‘don’t know’).

Results

The first aim of this study was to examine, using the PAS scale, whether endorsement of psychology as a science increased with experience of the subject. Cohen’s kappa for the 15 items of the PAS was .72. Participants’ mean scores on the PAS (scaled on the seven point scale) were 5.3 (SD = 0.7) for Group 1, 5.5 (SD = 0.6) for Group 2 and 5.9 (SD = 0.7) for Group 3 (see Table 1). These scores are significantly above the neutral rating of 4 ($p < .01$), indicating moderate to strong agreement that psychology is a science. This level of agreement is consistent with ratings reported in other studies. For example, Amsel et al. (2009) reported an average of 5.0 for students six weeks into an introductory

psychology course, rising to 5.1 at the end of the semester. Friedrich (1996) reported an average score of 5.1 for introductory psychology students at the end of the semester and of 5.3 for students of more advanced psychology methods courses. Amsel, Baird and Ashley (in press) reported a PAS score of 5.7 for senior psychology majors. A one way analysis of variance showed a significant difference in PAS scores among the three groups, $F(2,175) = 8.9, p < .01$. Post hoc testing showed that Group 3 showed significantly higher PAS ratings than the two other groups.

Table 1: Means, with standard deviation in parentheses, on the R-PBS, its two sub-scales (New Age Philosophy and Traditional Paranormal Beliefs), the PAS and agreement with the misconception items.

	Group 1 (n = 83)	Group 2 (n = 55)	Group 3 (n = 40)
R-PBS Full scale	67.8 (23.3)	62.4 (21.44)	58.9 (19.99)
New Age Philosophy	29.8 (11)	27.9 (10.4)	26.3 (8.9)
Traditional Paranormal Beliefs	15.3 (6.1)	14.3 (5.7)	13.6 (6)
PAS	5.3 (.73)	5.5 (.6)	5.9 (.73)
Misconceptions	11.5 (3.60)	7.6 (3.8)	9.4 (3.9)

Endorsement of the psychology misconceptions was computed by counting the number of statements students agreed with. A rating of 5 or above was taken to indicate agreement. One item was identified as ambiguous based on participant feedback and removed from the analysis. Table 2 shows the percentage of students in each group agreeing with each of the remaining 19 statements. Overall agreement was 61% for Group 1, 40% for Group 2 and 50% for Group 3, figures that are similar to previous studies. For instance, Vaughan (1977) found 39.5% agreement; Lamal (1979) reported 41%–43%; Gardner & Dalsin (1986) reported 38% and Griggs & Ransdell (1987) reported 40%. Considering that our questionnaire removed items that were considered ambiguous by these and other studies, and that it used a 7-point scale response format, we would have expected our participants' scores to fall at the upper end of these reported values. If we consider only strong agreement with the statements (a rating of 6 or above), total agreement falls to 40% for Group 1, 21% for Group 2 and 25% for Group 3 (see Table 3). Overall, a majority of all three student groups agreed with 5 of the nineteen erroneous statements (see Table 2).

A one-way analysis of variance showed a significant difference between the three groups, $F(2, 177) = 21.2, p < .01$. Post hoc tests showed that while Group 1 produced higher agreement with the misconceptions compared to both Group 2 and Group 3, the group with the lowest agreement on the misconceptions was Group 2.

Table 2: Percentage agreement with statements on the psychology misconceptions questionnaire. Statements on which a majority of students agreed, in all year groups, are shown in bold. % agreement counts any rating above the neutral 4 response; strong agreement, a rating of 6 or 7, is shown in parentheses.

	Group1	Group 2	Group 3	Average
People commonly repress traumatic memories.	88 (76)	78 (56)	95 (73)	87.0
Subliminal messages can persuade people to buy products.	94 (82)	76 (53)	88 (55)	86.0
To change behaviour we must change attitudes.	87 (70)	73 (46)	85 (60)	81.7
Hypnosis is a unique trance state which differs from waking states.	78 (55)	60 (26)	90 (43)	76.0
It is easy to tell a liar by their facial expressions.	83 (52)	58 (27)	70 (35)	70.3
Some people are left-brained, others are right-brained.	69 (52)	44 (29)	75 (43)	62.7
Hypnosis is useful for retrieving forgotten memories.	73 (47)	47 (15)	58 (25)	59.3
People can learn new information while they sleep.	60 (31)	46 (26)	53 (25)	53.0
The right side of the brain is the creative side	63 (45)	35 (20)	53 (25)	50.3
Handwriting can reveal personality traits.	63 (43)	42 (18)	45 (23)	50.0
Dreams possess symbolic meaning.	58 (39)	46 (24)	28 (3)	44.0
People only use 10% of their brain.	47 (30)	22 (13)	38 (23)	35.7
80% of the brain's potential goes unused.	46 (28)	18 (9)	43 (18)	35.7
Dream interpretation reveals unconscious wishes.	53 (24)	33 (11)	18 (5)	34.7
People's responses to inkblot tests can tell us about their personality.	58 (27)	18 (6)	13 (3)	29.7
Playing Mozart to infants boosts their intelligence.	37 (11)	26 (13)	20 (8)	27.7
Behaviour is influenced by moon phases.	33 (17)	16 (2)	28 (0)	25.7

Men and women have different dominant brain hemispheres.	35 (13)	16 (9)	18 (3)	23.0
Extrasensory perception is a proven phenomenon.	27 (19)	7 (4)	25 (8)	19.7
<i>Average agreement</i>	<i>60.6</i>	<i>40.1</i>	<i>49.6</i>	<i>50.1</i>

Some individual items can be compared across published studies. For example, some version of the “to change behaviour we must change attitudes” statement is included in many studies. On our item, 82% of students agreed with this statement. Vaughan (1977) found that 92% of her sample agreed with a similar item, while Lamal (1979) reported 91%, Gardner and Dalsing (1986) reported 84% and Griggs and Ransdell (1987) reported 76%. Green, Page, Rasekhy, and Bernhardt (2006) found that 77% of their college student sample endorsed the statement “hypnosis is an altered state of consciousness, quite different from normal consciousness”. McConkey (1986) reported 62% agreeing. In the current study 76% of students agreed with a similar statement (“hypnosis is a unique trance state which differs from waking states”).

Group 3 students were significantly more likely to agree with the statements than those in Group 2, $t(93) = 3.3, p < .01$. The proportion of neutral (4 – ‘don’t know’) responses did not differ significantly between the groups (at .25 in Group 2 and .21 in Group 3). Examining responses to the individual statements (see Table 2), it is apparent that the 5 statements that generated majority agreement overall, showed higher ratings in Group 3 compared to Group 2. The lower ratings in Group 2 may reflect the fact that the material was somewhat biased towards topics being covered in that year of the curriculum. This may suggest a ‘rebound effect’ whereby misconceptions that are temporarily reduced by teaching content are re-established once course content moves to other areas.

Table 3: Correlations between scores on the PAS, R-PBS and the total number of agreements (with any score above 4 marked as agreement) on the misconceptions questionnaire

	PAS			Misconceptions		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
Total R-PBS	-.222*	-0.06	-.204	.188	.472**	.142
New Age Philosophy	-.247*	-.082	-.295	.228*	.441**	0
Traditional Paranormal Belief	-.124	-.0112	-.06	.206	.456**	.155
PAS	1	1	1	.086	-.22	-.148

* correlation is significant at the 0.05 level (2 tailed)

** correlation is significant at the 0.01 level (2 tailed)

Scores on the R-PBS did not differ by group (see Table 1). The current Irish university sample demonstrated lower traditional religious values and generally lower paranormal beliefs than reported for student samples from the United States (e.g., Roig et al. 1998; Tobacyk, 2004) and for a student and non-student sample in the United Kingdom (Watt, Watson & Wilson, 2007). Correlation coefficients for the key measures are shown in Table 3. Scores on the New Age Philosophy subscale of the R-PBS were positively associated with agreement with psychology misconceptions for Groups 1 and 2, but not for Group 3, the group with the most experience of psychology. There was no association between responses on the PAS and agreement with the misconceptions items.

Discussion

The purpose of the current study was to examine the relationships between misconceptions about specific knowledge areas of relevance to the discipline, beliefs about the nature of psychology as a discipline and the status of anti-scientific thinking in three groups of psychology students, differing in experience of psychology. The students’ scores on the PAS suggested moderate to strong agreement that psychology is a scientific discipline, and scores on the PAS were significantly higher in students with more academic experience of the subject. However, scores on the PAS did not correlate with scores on the misconceptions questionnaire. Furthermore, while agreement with misconceptions was lower in the two groups with more experience of psychology, the group with the most experience did not produce the lowest scores, and on average indicated agreement with almost half of the statements. This suggests that students are able to ‘compartmentalize’ and maintain popular erroneous beliefs about claims relevant to psychology even as their appreciation of the scientific basis for psychology as a discipline increases (see also Kowalski & Taylor, 2006; Miller, Wozniak, Rust, Miller, & Slezak, 1996).

This assumes that the PAS measures the students' grasp of psychology as a science and that the students are not simply reporting what it is they think the researchers (as teachers of psychology) want to hear. It could be that psychology students realise that they are 'supposed to' report that psychology is a scientific discipline and that their responses are framed accordingly. If this were the case, the students' continued agreement with misconceptions would not be at odds with their PAS responses. However, Amsel et al. (2009) had students complete the PAS from their own and their instructors' perspectives and found a lower PAS score in the 'own' perspective condition, suggesting that students are not just responding to expectations when they complete the PAS. Furthermore, PAS scores predict psychology examination performance, suggesting that PAS scores reflect true appreciation of the basic assumptions of the discipline; if students were 'giving us what we want to hear' on the PAS scale, there should be no relationship to academic performance.

Of the nineteen misconceptions analysed here, a majority of students in both groups agreed with five; a majority of the Group 3 students, who were approaching their final examinations, agreed with a further four. Agreement with the list of psychology misconceptions was significantly greater in Group 3 compared to Group 2. This difference between the groups may reflect specific content that is taught in this particular psychology course at year 2. Group 2 students were less likely to agree with misconceptions concerning the brain, memory and perception, topics covered in that year of study. In fact, the four statements that found majority agreement in Group 3 but not Group 2 are specifically addressed in year 2 teaching. This suggests that popular misconceptions can 'rebound', as Group 3 would have encountered similar course material in the previous academic year. In support of this suggestion, two items concerning dreams found higher agreement for Group 2 compared to Group 3, again reflecting content currently taught, this time for the final year students. A longitudinal analysis would ascertain the degree and duration of influence from current course content on misconception acceptance; however such analyses require students to be identified, which can be problematic for this type of research.

Total scores on the New Age Philosophy scale of the R-PBS were associated with higher agreement with psychology misconceptions for Groups 1 and 2, but there was no relationship between R-PBS scores and agreement with misconceptions in Group 3. If the paranormal beliefs subscales of the R-PBS are taken as a measure of anti-scientific thinking, then this correlation for Group 2, in the context of lower misconception agreement overall, could indicate a relationship between endorsement of misconceptions and poorer scientific thinking in spite of current course material. In Group 3, the higher agreement with the misconceptions overall suggests that popular misconceptions regain a foothold once they are not being countered in current course materials; in this case a measure of anti-scientific thinking does not predict who will be susceptible to these myths.

There was a negative correlation between scores on the PAS and on the R-PBS and its New Age Philosophy subscale for Group 1 students, that is, those students who have recently commenced the study of psychology. This relationship is not evident in the groups with more experience of the subject. This may reflect an attitude towards psychology in those drawn to it as a subject but who do not continue with it, either by choice or because they do not produce the required examination performance to continue.

Identifying the misconceptions that are particularly prevalent may be useful in pointing to areas where teaching might focus additional attention (Gardner & Dalsing, 1986). The five statements that generated agreement of a majority of students in all groups are classic popular misconceptions, and are ranked here in order of average agreement across the three groups:

1. People commonly repress traumatic memories (87%);
2. Subliminal messages can persuade people to buy products (86%);
3. To change behaviour we must change attitudes (82%);
4. Hypnosis is a unique trance state which differs from waking states (76%);
5. It is easy to tell a liar by their facial expressions (70%).

The Group 3 students, who were approaching their final year examinations, produced majority agreement on a further four statements, ranked here in order of average agreement for that group:

1. Some people are left-brained, others are right-brained (75%);
2. Hypnosis is useful for retrieving forgotten memories (58%);
3. The right side of the brain is the creative side (53%);
4. People can learn new information while they sleep (53%).

Many of these misconceptions, and the psychological evidence against them, are discussed by Lilienfeld, Lynn, Ruscio and Beyerstein (2010). Some of these statements are obviously false, even to those without training in psychology, and yet their pervasiveness in folk psychology sees them readily agreed with. For example, an introductory psychology student could readily provide challenges to the statement, “to change behaviour we must change attitudes”, and yet, psychology students in this study, as in other studies, agree with the statement, when it is presented in this form. Do they really agree with this statement? Or are responses biased by the format and language used? Or are we seeing a non-scientific mode of thinking being applied to ‘folk psychology’ issues? Similarly, the statement “people commonly repress traumatic memories” might generate agreement because of the ambiguity created by the word ‘commonly’ – what exactly do we mean by ‘common’ here? Do students read this statement as something more akin to “repression of memory is possible”? Many of the nineteen statements used (see Table 2) could be criticised on similar grounds; this difficulty with devising a list of clearly and unambiguously erroneous statements has been noted throughout the literature (e.g., see Brown, 1984; Griggs & Ransdell, 1987).

Assuming that endorsement of misconceptions reflects faulty reasoning of some type, how might we change this type of thinking? Some studies support the benefits of a refutational approach in countering students’ common sense beliefs about psychology (Kowalski & Taylor, 2009). Miller, Wozniak, Rust, Miller and Slezak (1996) found that students changed their inaccurate beliefs about psychology as they were required to write an essay that contradicted those beliefs. However, most studies to date have only measured short term reduction in such misconceptions; our data suggest a ‘rebound’ effect that requires longer-term investigation. Furthermore, as noted by Lilienfeld (2010), debunking misconceptions in the classroom has its risks; sometimes students remember the misconception but not the source or the ‘negation tag’ telling them that the statement is inaccurate; in such cases misconceptions might be strengthened rather than eradicated.

Other approaches advocate targeting student misconceptions by presenting their beliefs about the discipline in a coherent and consistent manner and allowing the students to refine the competing beliefs (e.g., Amsel et al., 2009; Lilienfeld, 2010). However, Zachar and Leong (1992) suggest the appreciation of scientific method comes down to personality – teaching may not change this. It may be that students have multiple belief systems and adapt their thinking according to context (Amsel et al., 2009), in which case direct and repeated challenges to psycho-myths may be essential for their eradication.

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