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John Haw
Southern Cross University

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Improving Psychological Critical Thinking in Australian University Students

John Haw

Abstract

This study tested the psychological critical thinking attributes of students undertaking an Australian Psychology Accreditation Council (APAC) approved course. It also assessed an instructional based teaching practice designed to improve psychological critical thinking skills. The participants were 84 second year and 60 fourth year psychology students enrolled at the University of Western Sydney, Australia. Participants were tested at the beginning and end of the semester with the Psychological Critical Thinking Exam (PCTE) (Lawson, 1999) and only the second year group received specific critical thinking instructions. The results revealed a significant ($p < .001$) increase in mean PCTE score for the second year group, but no significant increase for the fourth year group. These results confirm the value of the instructional based teaching practice and support the graduate attributes expected by the APAC.

According to the rules and standards for the accreditation of a three year course in psychology, graduates must have a solid foundation in six core psychology graduate attributes (Australian Psychology Accreditation Council, 2009). One of these six attributes is critical thinking skills and the APAC (2009, p. 43) expect that psychology graduates have the ability to "*apply knowledge of scientific method in thinking about problems related to behaviour and mental processes; question claims that arise from myth, stereotype, pseudo-science or untested assumptions*" and "*recognise and defend against the major fallacies of human thinking*".

The Psychological Critical Thinking Exam (PCTE) was designed to test undergraduate psychology students' ability to judge the merit of conclusions to a variety of scenarios (Lawson, 1999). According to Lawson, psychology students should possess the skill to identify a weak or faulty conclusion if it is based on a lack of empirical evidence, testimonial or anecdotal evidence, unfalsifiable theories, biased samples or simple correlational data. Many of these skills fit within the APAC definition of critical thinking. In testing on a North American sample of college students, the PCTE was able to differentiate between senior psychology majors and students enrolled in an Introduction to Psychology subject and also between senior psychology majors and other senior science majors (biology and chemistry). In both instances, the senior psychology majors scored significantly higher on the PCTE than other students.

In Australia, a specific critical thinking test such as the PCTE may be a useful tool to assess the critical thinking requirements of the APAC approved curricula. In the undergraduate accredited psychology major at the University of Western Sydney, students must enrol in a research methods subject when in the first semester of their second year. The

content of this subject includes both a statistical and a methodological component. The methodological component focuses on an introduction to the principles of scientific research. The method of teaching this content includes an instructional format designed to promote critical thinking (Peningroth, Despain & Gray, 2007; Williams, Oliver, Allin, Winn & Boother, 2003; Williams, Oliver & Stockdale, 2004). Specifically, weekly exercises (questions and tasks) were provided to students which require them to critique methodologies and formulate their own conclusions in a scientific manner, using the available evidence. These exercises were scenario based and similar to those of the PCTE, but require students to develop hypotheses, analyse data, determine the fate of the hypotheses and then assess the validity of the conclusion on methodological grounds. Furthermore, around 20 minutes of time is set aside during the 2 hours of lecture time each week to discuss these exercises and this type of group interaction has been reported to promote higher order reasoning (Garside, 1996; Tsui, 1999).

The University of Western Sydney also provides an APAC accredited fourth year in psychology. These students must have completed an APAC accredited three-year sequence in psychology to enrol in fourth year subjects. Hence, these recent graduates are suitable for assessing the critical thinking requirements desired by the APAC accreditation rules. These students must also undertake a research methods subject, however the focus is on advanced statistics with no specific methodological content.

Based on the structure of the APAC approved psychology major, it is hypothesised that students who have progressed through an APAC approved three year sequence will score significantly higher on the critical thinking exam than students who have not. That is, fourth year students will score significantly higher on the PCTE than second year students.

Furthermore, based on Williams et al. (2003, 2004) and Penningroth et al. (2007) it is hypothesised that students exposed to explicit instruction in psychological critical thinking over the course of a semester will show a significant improvement in critical thinking when compared to students who are not. That is, a significant interaction will be found with second year students scoring significantly higher on the PCTE at the end of their research methods subjects compared to the start, and fourth year students showing no significant difference over the same period.

Method

Participants

All students who attended the first and last lecture of either the second year or fourth year research methods subjects were invited to participate. At Time 1 there were 208 second year students and 90 fourth year students who completed the questionnaire. However, at Time 2 there were only 84 second year students and 60 fourth year students who completed both Time 1 and Time 2 questionnaires. Of these, the second year students comprised 20 men and 64 women with a group mean age of 22.75 years (SD = 6.74). The fourth year students comprised 11 men and 49 women with a group mean age of 25.98 years (SD = 8.18).

Materials

The Psychological Critical Thinking Exam (Lawson, 1999) was administered to all participants. This test was provided by Lawson along with the scoring key, however, some of the wording in the scenarios was changed to suit the Australian context (e.g. political parties). The PCTE is an essay format instrument that presents 14 scenarios with a concluding

statement. Participants are asked to state whether or not there is a problem with the scenario's conclusion and explain the problem (if they thought there was one). For example, one scenario reads:

A researcher tested a new drug designed to decrease depression. She gave it to 100 clinically depressed patients and discovered that their average level of depression, as measured by a standardised depression inventory, declined after 4 months of taking the drug. She concluded that the drug reduces depression.

The maximum score on the PCTE is 14 (1 point for each scenario) and each scenario contains a faulty conclusion. However, it should be noted that other researchers have slightly modified Lawson's original scoring methods (e.g., Penningroth et al., 2007; Williams et al., 2003, 2004) to more sensitively measure levels of critical knowledge, although the details of these scoring keys have not been published.

Participants received seven of the scenarios (the odd numbered scenarios) in the first week of Autumn semester (Time 1) and the other seven (the even numbered scenarios) in the last week of Autumn semester (Time 2). This represented a 12 week difference between Time 1 and Time 2.

Procedure

This study was approved by the Human Research Ethic's Committee at the University of Western Sydney. For testing at Time 1, a questionnaire was constructed containing the seven items from the PCTE along with questions about age, gender and the students' university identification number. The questionnaire at Time 2 contained the remaining seven items from the PCTE and also asked the students' identification number. This identification

number was required to match the questionnaires from Time 1 and Time 2. Students were informed that the PCTE was administered for research purposes and was not an assessment item for the subject they were enrolled in. Participant answer sheets were then randomly distributed to four postgraduate students who were trained by the author in marking according to Lawson's criteria. Markers were instructed not to indicate their score on the exam to allow for a blind re-marking procedure. Once all papers were marked, each postgraduate student re-marked another ten randomly selected answer sheets (ie. 70 scenarios) from a different marker. This process occurred after both Time 1 and Time 2 and the inter-rater reliability was found to be Kappa = .76 ($p < .001$) for Time 1 and Kappa = .83 ($p < .001$) for Time 2. Given the high inter-rater reliability between markers, where there was disagreement between markers it was decided to retain the score from the original marker.

Results

Due to the large attrition rate between Time 1 and Time 2, an analysis was conducted to determine if there was a significant difference in PCTE score at Time 1 between those who remained in the study and those who did not. For the second year group there were 124 students who only participated at Time 1 and 84 students who completed testing at both Time 1 and Time 2. An independent samples t-test revealed no significant difference ($p = .98$) in mean Time 1 critical thinking score between the two groups. The same comparison was conducted between the 30 fourth year students who only participated at Time 1 and the 60 fourth year students who participated in both stages. Again, no significant difference was found ($p = .12$) in PCTE score at Time 1.

To test the first hypothesis that fourth year students would score significantly greater on the PCTE than second year students, an independent samples t-test was performed on these groups at Time 1. All participant scores at Time 1 (ie. the 208 second year and 90 fourth year students) were included in this analysis. Results indicated a statistically significant difference with $t(296) = 10.94$, $p < .001$, 95% CI of the difference: 1.65 – 2.38. The mean PCTE score for the second year group was 1.86 (SD = 1.38) and for the fourth year group was 3.88 (SD = 1.63). Hence, the hypothesis that fourth year students would score significantly higher on mean PCTE score, was supported.

To test the second hypothesis that there will be an interaction between Year of study (second year/fourth year) and Time (beginning/end of semester) a 2 x (2) mixed ANOVA was undertaken. This data set comprised the 84 second year and 60 fourth year students who completed both stages. Data were first checked for the appropriate parametric assumptions. There were no significant outliers among the four cells (all $z < 3.29$) and no significant skewness or kurtosis for any of the four cells (all $z < 3.29$). The assumption of homogeneity of variance for the between-groups variable (Year of study) was met for both time periods ($p = .71$ and $p = .21$) and the assumption of homogeneity of covariance was also met ($p = .29$).

The analysis revealed a significant Time x Year of study interaction $F(1, 142) = 33.83$, $p < .001$. This interaction explained 16% of the variance in PCTE scores (ie $\eta^2 = .16$). Table 1 provides the mean and standard deviation score for each cell. As shown in Table 1, second year students improved over the course of semester by 1.71 points on the PCTE. However, fourth year students did not record any improvement.

Table 1.

PCTE means (out of 7) and standard deviations for Time x Year of study.

	Time 1	Time 2
	M (SD)	M (SD)
Second Year	1.86 (1.45)	3.57(1.45)
Fourth Year	4.07 (1.49)	4.05(1.69)

Discussion

The results of the current study supported both hypotheses. The first hypothesis predicted that fourth year students would score significantly higher on critical thinking than second year students. This was based on the graduate attributes that form part of the APAC accreditation standards. The results revealed that at the beginning of their first semester, fourth year students did score significantly higher on psychological critical thinking than second year students. The results from testing of the second hypothesis found that second year students displayed a significant improvement in critical thinking ability over the course of the semester whereas fourth year students did not. It is suggested that this was due to the specific instructions related to psychological critical thinking that included practice questions, feedback and group discussion.

The results of this study are important for a number of reasons. They support the value of specific critical thinking instructions and relevant exercises to improve psychological critical thinking. It is suggested that the gains in critical thinking by second

year students was a result of this aspect of the teaching program. The exercises were augmented with group discussions and the results also supported previous research into critical thinking and effective teaching practices (Garside, 1996; Penningroth et al., 2007; Tsui, 1999; Williams et al., 2003, 2004).

The absence of improvement in critical thinking by fourth year students also raises some important issues. Although no specific critical thinking instructions were provided in the fourth year research methods subject, these students were exposed to advanced statistics and were required to undertake a supervised research project. This project included a critical review of the literature and consideration of methodological issues in the design of their project. The absence of improved critical thinking suggests that these tasks are not engaging the student to think critically. However, the research project is undertaken by students over two semesters and it may be that testing at the end of the first semester did not allow enough time for advanced critical thinking skills to develop.

Another important aspect of the current study is that it is the first study to provide evidence that an Australian Psychology Accreditation Council approved undergraduate degree equips graduates with the desired critical thinking skills as stated in the APAC (2009) rules and standards. The results suggested that graduates with a three year accredited psychology sequence possessed significantly greater critical thinking skills than those who had only completed one year. Although the PCTE has not been validated against the APAC (2009) criteria, there appears to be good face validity that the PCTE measures the type of psychological critical thinking desired by the APAC (2009).

However, this study also raises some issues with the PCTE that should be considered in future research. The marking criteria are open to interpretation and this makes comparisons

across studies very difficult. This is further compounded by some researchers modifying the original marking scale (e.g., Penningroth et al., 2007; Williams et al., 2003, 2004) although there is some justification for this. The example from the PCTE provided earlier (drug for depression) was considered to have a weak conclusion because there was no control/comparison group. This meant that students answering with "*could be a placebo effect*" or '*may have got better over time*" would have been scored as incorrect and received zero. Although the instructions required students to *explain* their responses and these brief responses do not show a deeper understanding, a reasonable argument could be made that these answers are partially correct.

A number of other limitations with the study are worthy of mention. Observed changes in the PCTE for the second year group may have been due to influences other than the specific instructions and exercises. The other psychology units that ran concurrently with the research methods do not have explicit critical thinking components, but students still may have learned aspects of critical thinking over the course of their other studies.

With regard to the second hypothesis, a potential limitation was the quasi-experimental design and use of intact groups. This meant that students could not be randomly allocated to the second year or fourth year groups and this weakens the internal validity of the study. This is important as it may have been that fourth year students were simply more academically developed than the second year students. Not all second year students will have the grades or the motivation to pursue a fourth year in psychology and the difference between these groups may not have been due to the benefits of an APAC accredited sequence in psychology, but rather due to the attrition of academically weaker students.

Greater testing of the graduate attributes from an APAC accredited degree is needed and this should include collaborative research among universities. Future studies need to bear the limitations of the current study in mind and should also consider ways to maximise student participation. The reduction in numbers from Time 1 to Time 2 was most likely due to the scheduling of Time 2 in the last lecture of the semester. Students appeared less likely to attend this lecture and also less likely to remain in the lecture for the allocated time. With a greater sample size it may be possible to further analyse the data with regard to student academic performance (high/low) without jeopardising the power of the test (Penningroth et al., 2007; Williams et al., 2004). Overall, this study provides support for a teaching practice that may enhance psychological critical thinking skills and also adds some empirical support to the development of these skills under an accredited psychology degree in Australia.

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