The Effect of Perspective on Misconceptions in Psychology: A Test of Conceptual Change Theory

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To test whether students' knowledge about psychology undergoes a conceptual change when learning about the discipline, 227 Introductory Psychology students from six different classes were given the Psychology as a Science (PAS) Scale in one of two conditions. Students were randomly assigned to complete the questionnaire from their own (Self Condition) or their psychology professor's (Professor Condition) perspective. As predicted, results show scores on the PAS Scale were higher, reflecting greater appreciation for psychology as a science, in the Psychology Professor than the Self condition. These results suggest that learning psychology may be less about "reflecting on and revising" misconceptions and more about "sorting out" which beliefs are associated with scientific psychology and which with students' own intuitive understanding of the discipline.

To account for how students learn science disciplines, Posner, Strike, Hewson, and Gertzog (1982) proposed Conceptual Change theory, based on the idea that science learning is a rational and intelligible process (also see Carey, 2000; Duit, 2003; Nesessian, 1989; Strike & Posner, 1992). The theory states that students' ability to learn a scientific discipline will be limited by their holding disciplinary misconceptions, that is, beliefs that are incompatible with the core concepts of the discipline. It is proposed that in order for learning to occur, students must first critically evaluate misconceptions and revise them to be compatible with the discipline.

This account has been applied to students learning many scientific disciplines (Duit, 2003; Carey, 2000). One purpose of the present study is to apply this account to students learning psychology, who often misclassify the discipline as less scientific than physics or astronomy. According to Stanovich (2007), students enter an Introductory Psychology class thinking that Freudian theory is largely what psychology is all about or that pop culture psychologists represent all psychologists in general. Previous research has identified a range of psychological claims which students believe about the discipline despite having been proven false by psychological research (Gardner & Dalsing, 1986; Kowalski & Taylor, 2006; McCutcheon, 1991; McCutcheon, Hanson, Apperson, & Wynn, 1992; Thompson & Zamboanga, 2004). For example, students readily believe that *Good hypnotists can force you to do anything they want you to do,* and that *genius is akin to insanity* despite evidence disconfirming such claims (c.f., Gardner & Dalsing, 1986). Furthermore, research suggests that students decrease in their misconceptions as they take more psychology courses (Gardner & Dalsing, 1986; Kowalski & Taylor, 2006; McCutcheon et al., 1992).

These studies provide weak evidence for conceptual change as the process by which students learn psychology. The questionnaires used to assess psychology students' misconceptions may have reliability and validity problems. In the studies, some researchers (e.g., Garner & Dalsing, 1986),

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find higher misconception rates than others (McCutcheon, et al., 1992), suggesting a lack of measurement reliability in the misconceptions assessments. Moreover, a number of studies report no relation between students' misconceptions performance and their grade in their psychology classes (McCutcheon, et al., 1992; Thompson & Zamboanga, 2004), which would seem to be a violation in measurement validity if misconceptions are supposed to index a constraint on learning, as theoretically proposed (Posner et al, 1982). Finally, the finding of a decrease in misconceptions rate among students taking a psychology class may be due to professors specifically addressing and clarifying the misconceptions students held (Kowalski & Taylor 2006). It could be argued that the assessment did not measure how well students are able to critically reflect on and revise misconceptions, as theoretically proposed, but how well they were able to answer the "correct" answer that was given to them by their professor.

Others have criticized this "misconceptions research" as addressing only superficial psychological beliefs, and not deep epistemological misunderstandings of the discipline (Amsel, Frost, & Johnston, submitted; Friedrich, 1996). To address this issue, Friedrich (1996) created a questionnaire to assess students' misconceptions about the scientific nature of psychology, titled the *Psychology as a Science* (PAS) questionnaire. The questionnaire was shown to have good measurement reliability (with internal consistency scores ranging from .7 to .8) and validity. Research methods students at the end of the semester scored higher ($M = 5.55$ on a 7 point Likert scale, reflecting a stronger belief in psychology as a science), than the same students at the beginning of the course ($M = 5.30$) and different students from an introductory psychology course who were tested at the end of the semester ($M = 5.11$).

Even though Friedrich (1996) showed that the PAS was a valid and reliable measurement device, there is still no evidence that changes in PAS scores reflect a conceptual change. That is, there is no evidence of students actually reflecting on and revising their beliefs. Perhaps the metaphor of students as scientists, with a belief system regarding psychology that is rife with misconceptions but which undergoes conceptual change may not be apt. It is possible that students in fact have multiple belief systems regarding how to think about a scientific discipline, and that one system dominates in certain contexts. If students have multiple ways of thinking about psychology, then it is possible that under certain circumstances students' more scientific beliefs about the discipline could be elicited. From this perspective, learning about psychology may be less about "reflecting on and revising" misconceptions and more about "sorting out" which beliefs are associated with scientific psychology and which with their own intuitive understanding of the discipline.

To test these accounts of students' learning of psychology, Introductory Psychology students were assessed to determine whether their scientific and intuitive beliefs about the discipline can be elicited in different contexts. The students were asked to complete the PAS questionnaire on the basis of their own beliefs (Self Perspective) or their Psychology professor's beliefs (Professor Perspective). If, as proposed by Conceptual Change theory, students are constrained by their misconceptions about the discipline, then their PAS score should not differ in the two conditions. However, as proposed here and by others (Smith, DiSessa, & Roschelle, 1993) science students may entertain multiple belief systems which become better coordinated with learning. According to this theory, Introductory Psychology students' PAS scores may be higher in the Professor than Self condition, reflecting the possibility of coexisting beliefs.

Method

Participants

The participants of this study were 227 students who were enrolled in Introductory Psychology courses at a regional university in the intermountain west. Students were enrolled in one of six classes, three of which were taught by male professors and three others by female professors. Of the students sampled, 61% were female, 39% were male, and 67% were freshmen, 26% were sophomores, and the remaining 7% were juniors or seniors. The average age of the students was 20.13 years with a standard deviation of 3.78 years. The range of the student ages was 18 years to 47 years. Students were randomly assigned to either the Self (n = 115) or the Psychology Professor (n = 112) condition. The two groups were not different in demographic variables (age, sex, student status) or course/discipline-related variables (interest in psychology, anticipated or actual grade, their enjoyment of the class, and other psychology courses taken, including high school). Students signed informed consent forms and were given research credit for their participation in the study.

Measure

The measure used in this study is a modified version of the one used in Friedrich's (1996) study. Twenty questions concerning basic concepts of psychology as a science are included, with five filler items. Of the 15 experimental items, seven were reverse-scored questions and eight positive-scored questions. The questions were developed to assess students' beliefs in the scientific status of psychology, such as the importance of research, the scientific nature of psychology, and the effectiveness of psychology in predicting human behavior (Friedrich, 1996). The questionnaire was on a single page. On the front page were the demographic questions regarding students' sex, academic year, age, present grade in the course, anticipated grade in the course, psychology major or minor status, consideration of a possible psychology major or minor, how much the student is enjoying the class, and how many psychology classes the student had previously taken. A four-point scale assessed whether students were considering becoming a psychology major or minor, with one being "I am not thinking about becoming a psychology major at all," and four being "I am very likely to become a psychology major or minor." This scale was also used for the question concerning how well the student is enjoying the class; one indicated "I am not enjoying it at all," and four indicated "I am really enjoying it a good deal." On the back of the page was the PAS questionnaire. The directions were changed slightly from Friedrich (1996) to accommodate each perspective condition. Students in the *Self Perspective* were given these directions:

Listed below are a number of statements. Each represents an opinion regarding some aspect of psychology. Evaluate each statement from your own personal perspective. You will probably agree with some of these statements and disagree with others; there are no correct or incorrect answers. Read each statement carefully and indicate the extent to which you personally agree or disagree by writing in the appropriate number from the following scale.

In contrast, students in the *Professor Condition* were given these directions:

Listed below are a number of statements. Each represents an opinion regarding some aspect of psychology. Evaluate each statement from your psychology professor's perspective. Your psychology professor will probably agree with some of these statements and disagree with others; there are no correct or incorrect answers. Read each statement carefully and indicate the extent to which your psychology professor agrees or disagrees by writing in the appropriate number from the following scale.

An attempt was made to keep the instructions as similar as possible between the two

conditions. The items used were the same as in Friedrich's (1996) original PAS Scale. Students rated on a Likert scale how much they agreed or disagreed with the questions, with 1 being "Strongly Disagree", and 7 being "Strongly Agree." Another modification from Friedrich's original design was that the scale was placed on the top of the page so that the student could enter the value (1-7) corresponding to their opinion.

Procedure

Students were assessed in approximately the sixth week of class. Two research students distributed the questionnaires and consent forms in each of the six Introductory Psychology classes. Students were block randomized into the Self or Psychology Professor condition. Participants were reminded of the importance of reading the instructions before completing the questionnaire.

Results

Participants' average PAS scores were computed. The average score (scaled on the 7 point scale) was 5.20 (sd=.60), which was significantly above 4, $t(222)=29.73$, $p<.001$, suggesting a moderate agreement with psychology as a science.

Students' average PAS scores were entered into a 2 (Self vs. Psychology Professor) by 6 (Instructor) ANCOVA independently of demographic- and discipline/course-related variables. There was an effect of Perspective, with participants scoring higher in the Professor condition (M=5.37) than in the Self condition (M=5.01), $F(1,179)=15.41$, $p<.001$, $\eta_p^2=.079$. There was also an Instructor effect which approached significance, $F(5,179)=2.41$, $p=.057$, $\eta_p^2=.058$, see Figure 1. There was no Professor by Perspective interaction effect, $F(5,179)=.87$, *ns*.

Students' self-reported current grade and anticipated final grade in their Psychology class were correlated with their PAS scores. Partial correlations between grades and PAS scores were performed (independently of demographic- and discipline/course-related variables) for participants in the combined sample and for those in each Perspective

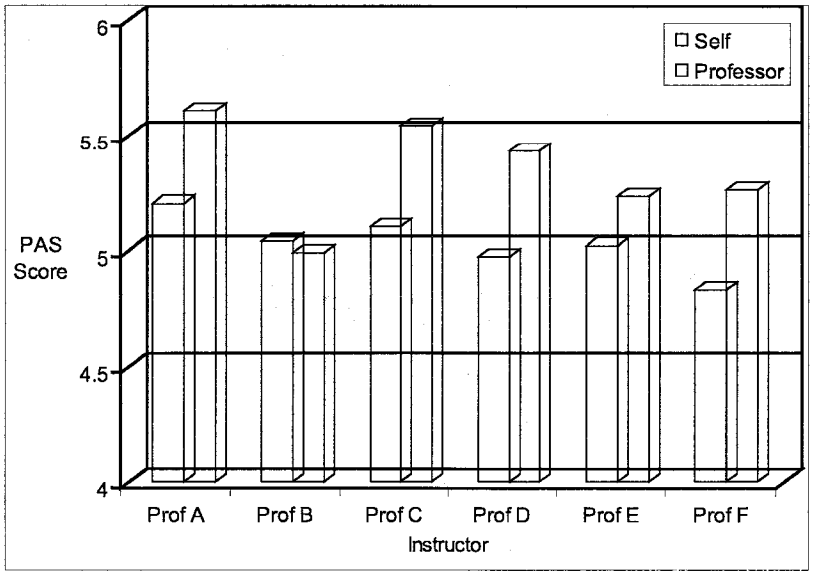

Figure 1. Average PAS score by perspective (Self vs. Professor) and instructor.

(Self and Psychology Professor) condition (see Table 1). The results revealed that higher self-reported 6th week grade was positively associated with a belief in psychology as a science in the combined sample. When analyzed separately, the correlation was stronger in the Professor than in the Self condition. Similarly, higher self-reported anticipated final grade was positively associated with a belief in psychology as a science in the combined sample. In this case, separate analyses revealed a significant positive correlation between anticipated final grade and belief in psychology as a science only in the Professor but not Self condition.

Discussion

As predicted, psychology students in the Professor Condition scored higher, meaning they rated psychology as being more scientific, on the Psychology as a Science Questionnaire than did students in the Self Condition. Students in the Professor Condition scored a mean of .29 higher than students in the Self Condition, confirming our hypothesis. This confirmation can be trusted for several reasons. First, students were randomly assigned to conditions to control for any extraneous variables. Second, the significant perspective effect obtained despite statistically controlling for extraneous variables that may have affected the previous studies, such as students' interest in the field, enjoyment of the class, and present and anticipated grades.

Third, unlike previous "misconceptions" studies, the PAS Scale was used to test students' misconceptions about *core* beliefs in psychology rather than using other measures to assess misconceptions more about superficial discipline-related beliefs. In addition, the measurement validity of PAS was stronger than other misconception instruments because, as per theoretical expectations, PAS scores predicted students' course grades.

The average score of students in the Self condition (M=5.01) after 6 weeks of an Introductory Psychology class corresponds well to the score, reported by Friedrich (1996), of Introductory Psychology students taken at the end of the semester (M=5.11). This provides a measure of external validity for the results of the present study. Furthermore, the introductory students' PAS score in the Psychology Professor condition (M=5.37) is slightly higher than Friedrich's (1996) report of the scores of advanced Psychology Methods students (who are likely Psychology majors) at the beginning of the semester (M=5.30). This suggests that less advanced students' grasp of their psychology professors' beliefs

Table 1
Partial Correlation Coefficients between PAS scores and Grades by students in the Self, Professor and Combined Groups.

	Groups Combined (n=227)	Professor (n=112)	Self (n=115)
6th Week Grade	.24***	.28*	.22*
Anticipated Final Grade	.20**	.21*	.18

*$p < .05$; **$p < .01$; ***$p < .001$

correspond to the beliefs of more advanced students who major in the discipline. Finally, the difference between the Self and Professor Conditions (M=.29) parallels the difference Friedrich (1996) reports between students at the beginning and end of their Research Methods course (M=.25). This finding suggests that the magnitude of change due to learning corresponds to the magnitude of the difference due to perspective. It is difficult to explain these findings in any other way than to say that early on in their academic career, students can represent the disciplinary-related beliefs of their professors, which are adopted by students who major in the discipline.

The Instructor effect that approached significance suggests that the grasp of psychology of science by students is not uniform across classes. The trend is independent of the extent to which students liked their professor (a variable statistically removed from all the analyses) or were likely to become psychology majors. The trend may be a result of characteristics of students (perhaps students signed up for one time/day/instructor are different than those who sign up for another time/day/instructor), instructors (perhaps instructors differ in their skills or goals to present psychology as a science), or both. Future studies could examine characteristics of students (learning styles, cognitive abilities, etc.) and instructors (teaching styles, commitment to scientific psychology, etc.) to assess their impact on students' own beliefs in psychology as a science and their perception of their professors' belief. Furthermore, longitudinal designs can be used to better understand the dynamic changes in students' own and their representation of their professors' beliefs. Students could be asked to complete the PAS from their own and their psychology professor's perspectives multiple times over the course of the semester. The result of such a study would make clear whether the impact of an Introductory Psychology class affects students' own beliefs about psychology as a science, their representation of their professors' beliefs, or both.

The data provide evidence against a process of conceptual change in which students reflect on and revise misconceptions about a scientific discipline. Rather than students' holding one set of beliefs containing misconceptions which is replaced by a set without misconceptions, students seem to be able to simultaneously hold multiple belief systems. Introductory Psychology students represent their professors holding discipline-appropriate beliefs more strongly than they themselves hold. The process of learning the discipline may be less about "reflecting on and revising" misconceptions and more about "sorting out" beliefs associated with scientific psychology from those not associated with the discipline.

This finding has been replicated with students in a traditionally delivered physics class who gave correct responses more often on physics problems when asked to solve them as their professor would or how they think the problems should be solved (Amsel & Johnston, 2008). Physics students too may have multiple beliefs about the discipline which co-exist. A process of learning psychology or physics in which students hold multiple competing belief systems offers new ideas about teaching. Professors should not confront student misconceptions by forcing new ways of thinking on them. Rather, they should present their beliefs about the discipline in a coherent, consistent, and transparent way to allow students to better examine and refine their own thinking (Smith et al., 1993).

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