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"A Game We All Play"
Identity, Epistemology, and Transformation in Undergraduate Psychology Students

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Abstract

The epistemological commitments of any scientific discipline are reflected in the changing beliefs and identities of its students. Challenges to psychology's scientific legitimacy presented by the recent replication crisis have underscored the need for critical and reflexive pedagogical perspectives in the discipline. This study aims to capture undergraduate psychology students' changing views of their area of study, and what these changes suggest about tensions within the discipline. Interviews of first-year and fourth-year psychology students at the University of Toronto were analyzed using reflexive thematic analysis. Results show that the fourth-years, though more conversant with academic psychology's values and commitments than their younger peers, were more troubled by issues pertaining to ethical and epistemological validity. Fourth-years also reported feelings of alienation and disenfranchisement due to their practical powerlessness to address theoretical issues of which they were critically aware. The results suggest a loss of confidence in psychology's claims to knowledge, as well as a need for pedagogical change. Creating space in the curriculum and lab culture for reflexively critical inquiry and transformative perspectives would help mitigate the alienation and frustration expressed by many students.

The present study examines the epistemological commitments of psychology as reflected in the conflicts and tensions experienced by its largest group of "legitimate peripheral participants" (Lave & Wenger, 1991) – university students. Thematic analysis of interviews with first-year and fourth-year undergraduate psychology students is used to explore cross-sectional differences in commitments and epistemological stance across their program of study, revealing aspects of challenge within the broader contemporary discipline. A contextual background to this reflexive epistemological study is first described, followed by thematic interpretation of the interview transcripts, and finally a critical discussion of knowledge production and education in psychology.

Background

Physics contains many richly described accounts of students' commitments to their field and understanding of physical theory and knowledge, whether before, during, or after university education (e.g., Domert et al., 2007; Elby, 2001; Halloun & Hestenes, 1985; Lising & Elby, 2005; W. Roth & Roychoudhury, 1993; W.-M. Roth & Lucas, 1997; Zwickl et al., 2014). The same is true of biology (Borgerding et al., 2017; Hiley & Peat, 2012; Pieschl et al., 2008; Sandoval & Morrison, 2003; Wallace et al., 2003) and chemistry (Barger et al., 2018; Mazzarone & Grove, 2013; P. Grove & Lowery Bretz, 2010; Vhurumuku, 2011). This reflexive focus is even more established in social sciences such as sociology (Ashwin et al., 2014; Corte & Irwin, 2017; Ralston, 2020; Sebidi & Morreira, 2017).

Why such interest in the student of science? One straightforward motivation is a desire to identify and support students' learning needs. For example, physicists Ibrahim Halloun and David Hestenes (1985) write, "Each student entering a first-year course in physics possesses a system of beliefs and intuitions about physical phenomena derived from extensive personal experience … [which] must be the major determinant of what the student learns in the course" (p. 1043). They emphasize that good science education hinges on instructors' understanding of their students' epistemological commitments, inviting systematic research into what those commitments are. This is true of all science education and is one motivation for the present study.

But students of a scientific discipline are more than passive targets of pedagogical technique. They are also the "cognitive apprentices" (Brown et al., 1989) of their discipline, and to understand them reveals much about the nature and construction of the discipline itself. Roth and Roychowdhury (1993) preface their interpretive study of high school physics students with the observation that knowledge is not merely "transferred from the teacher's to the learner's head." The conception of education as a simple transfer rests on an objectivist epistemology, which assumes that the goal of scientific experts is to discover the singular truth about an external reality of objects with fixed, definite properties, and to convey that truth to students and other non-experts. This epistemology, the authors argue, has long been challenged by scientists and philosophers of science, who recognize that knowledge and its value are, to a significant degree, constructed through specific historical, cultural, or disciplinary lenses (Brown et al., 1989; Gergen, 1985; von Glasersfeld, 1985). If so, the student is less a passive recipient of "the truth" than an apprentice who learns how to adopt the expert's particular tools of truth-building. Furthermore, the student's epistemology is at every stage of education reflective of the discipline's own deeper commitments, for it is the discipline's concept of truth and its tools for justifying knowledge that are reproduced in transforming the student into an expert.

For this reason, scholars across the sciences have recognized the need to study their students with a reflexive eye. However, there is a paucity of such research in contemporary

psychology. What research exists has tended to rely on confirmatory, quantitative survey methods to examine psychology students' epistemological beliefs (e.g., Karimi, 2014; Landa-Blanco & Cortés-Ramos, 2021; Rosman et al., 2018; Soyyılmaz et al., 2017). These studies are valuable for testing specific predictions but, as confirmatory studies, they are not designed to reveal new or unexpected commitments, and, being quantitative studies, they cannot describe these commitments in rich narrative detail. The few qualitative accounts of psychological students' perception of the field (Goedeke & Gibson, 2011) or the nature of psychological knowledge (Kaartinen-Koutaniemi & Lindblom-Ylänne, 2008, 2012) are more than a decade old.

Research in educational psychology and epistemology provides some broader context for our study of the implicit epistemology of psychology students. Studies in these fields are informed by William Perry's (1968) developmental approach to epistemological commitments, and by Anthony Biglan's (1973) cross-sectional approach to epistemological stances across disciplines. Perry proposed a general trajectory from a naïve, absolutist stance toward a nuanced commitment to the epistemological assumptions of a given system. This schema, though revised and challenged by later scholars (Richardson, 2013; Schraw & Sinatra, 2004; West, 2004), continues to guide scholarship in the area. Perry's account reinforces our guiding assumption that psychology students will approach, through their study, an understanding and acceptance of the epistemological stance of their discipline, and will therefore reflect it in their commitments to knowledge production.

Studies following in the line of Biglan (Karimi, 2014; Schommer-Aikins et al., 2003; Stoecker, 1993) have emphasized the need to qualify the path of epistemological development according to disciplinary divisions, especially the separation of "harder" and "softer" disciplines, and pure and applied disciplines. One quantitative study (Karimi, 2014) classified psychology among the soft and pure disciplines, where students' epistemological stances were generally less absolutist and more sophisticated. However, this finding is complicated by psychology's replication crisis and ensuing legitimacy challenges in the years following its publication in 2014. The classification of psychology as "hard" or "soft," and "applied" or "pure," is arguably more contestable now than it was before the crisis.

Our field's replication crisis began in earnest around 2012, reaching its peak with the Open Science Collaboration's (2015) dismaying revelations. There is surprisingly little literature on how this disciplinary reckoning has affected the formation of our students. This is concerning for both reasons laid out above. First, instructors should not be left to guess at the gap between students' prior beliefs and their own disciplinary commitments – a gap which has undoubtedly changed, and probably widened, as both the popular image and meta-scientific assessment of psychology have undergone considerable change. This is especially pressing as the number of psychology students grows. In the U.S., for example, psychology majors now constitute 6% of graduates (National Center for Education Statistics, 2022). Second, at a time when the nature of our discipline and its knowledge claims are subject to intense theoretical debate (Shrout & Rodgers, 2018; Yarkoni, 2022), we ought not to ignore the empirical insights offered by our cognitive apprentices, in their understanding and evaluation of the truth-building tools we provide them. Students show us the situation at ground zero. Even as new calls go out every year to see psychology, its methods, and its findings in a different light, institutional inertia within psychology favours traditional beliefs about how to train students. Put another way, students show us the *actual* effect of the replication crisis as far as it concerns changes in our field's implicit epistemological and philosophical commitments.

This study was conducted to reveal our changing disciplinary identity through the thoughts, beliefs, and motivations of students. It comprises a thematic analysis of interviews with undergraduate psychology students at the University of Toronto. These interviews aimed at understanding students' experience of their formal education in psychology. The intent was to explore what students took their discipline, their identity within it, and the knowledge produced by it to *mean* and, especially, how this meaning changed over the course of their education. This insight into the personal transformation that characterizes disciplinary apprenticeship helps us understand the lived identity of our discipline today. Our analysis is in the tradition of critical psychology (Foucault, 1995; Hook, 2004; Teo, 2010, 2018), which aims to discover the implicit assumptions and conditions under which disciplinary knowledge is produced. Thus, like other critical scholars of epistemology, we reject the inevitability of these structuring assumptions and conditions, and aim instead to bring their historical contingency into focus in relation to real or imagined alternatives.

Method

Positionality Statement

At the time of writing, the interviewer and first author identified as a 21-year-old, ethnically Chinese, queer man enrolled in the study of psychology at the University of Toronto. Prior to the conception of the present study, the interviewer was engaged with the theoretical literature of critical psychology (Landa-Blanco & Cortés-Ramos, 2021; Yarkoni, 2022) and queer theory (Edelman, 2004; Muñoz, 2009; Ruti, 2017), which broadly informed the methodological approach adopted below. Moreover, the author was a classmate of the fourth-year students interviewed as one of two cohorts in the present study. The present study was also guided by a tendency of the cohort toward critical questioning and unrest with disciplinary strictures. The interviewer's positionality in this respect functioned, in retrospect, as much as cultural entrée as a potential source of bias. The second author is a cis-gender, heterosexual, middle-aged social psychologist of Iranian ethnicity employed as an Associate Professor in the Department of Psychology at the University of Toronto. His research over the years has focused on questions of culture, identity, and communication. His investment in the present study reflects his recognition of the acute need for critical reflexivity in psychology, the benefits of multidisciplinary and interdisciplinary scholarship, and the importance of supporting the efforts of students to question and transform their chosen discipline.

Theoretical Framework

The formal method adopted for the design and analysis of this study was Braun and Clarke's reflexive thematic analysis (TA; Braun & Clarke, 2006, 2019). TA is, minimally, a method for "identifying, analysing and reporting patterns (themes) within data" (Braun & Clarke, 2006). It consists of the following major steps: familiarizing oneself with the data; generating codes; generating themes;[1] reviewing and revising themes; and reporting overall structure. We selected TA for its fit with the epistemological assumptions that informed the study, as detailed below.

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[1] Codes are labels for "interesting features of the data," with which the data's meaning is condensed. Themes are "patterns of shared meaning underpinned or united by a core concept," by which codes are placed into an overall interpretive structure. See Braun and Clarke (2006, 2019).

The version of TA set out by Braun and Clarke (2006, 2019), now canonical in qualitative research, is used within different epistemological paradigms. The authors identify three primary classes of research using TA: coding reliability TA (e.g., Boyatzis, 1998), codebook TA (e.g., King & Brooks, 2017; Ritchie & Spencer, 1994), and reflexive TA. Coding reliability TA assumes the same post-positivist framework as standard quantitative psychology: it names its codes and themes in advance of data collection and seeks to make the process of coding data objective, using multiple raters and quantitative measures of inter-rater reliability. Codebook TA retains the use of structured codebooks, but embeds itself within a constructivist philosophy, emphasizing the subjectivity of data analysis and interpretation. Reflexive TA aligns its method fully with a constructivist philosophy: codes and themes are not pre-determined, but created through the researcher's consciously subjective reading of the data, her own identity and assumptions, and her interpretations. The result, then, is "not about following procedures 'correctly'…but about the researcher's reflective and thoughtful engagement with their data and…with the analytic process" (Braun & Clarke, 2019).

The assumptions of reflexive TA are well-suited to this study for two reasons: it is *exploratory* and it is *reflexive.* It is exploratory because we did not know what we would find out about these students. As discussed above, the extant literature does not directly address the questions of this study. The point was to discover *what* has happened to students in the wake of the replication crisis, not *whether* certain, pre-specified things have occurred. This precluded the possibility of fashioning a codebook in advance of the analysis.

The second point – that the study is reflexive – is also pertinent. The first author was, at the time of writing, an undergraduate psychology student at the University of Toronto. Many of the students interviewed were classmates. Therefore, interest in the topic of this study was highly personal, and its motivation came partly out of the suspicion that classmates' attitudes were betraying something disquieting about the field. Our own critical attitude is therefore central to the exploration, with the result representing not an objectively detached description of reality, but an interpretation co-constructed through our own perspective and those of the participants, so as to render their experiences intelligible. This epistemology, basic to any constructivist philosophy (Braun & Clarke, 2019; Brown et al., 1989), is at the heart of reflexive TA.

Design

Because this study was intended to reflect the possibility of transformation of belief over the course of a program of disciplinary education, we interviewed undergraduate psychology students consecutively as two groups: first-years (N = 19, mean age = 18.4) and then fourth-years (N = 12, mean age = 21.7). See demographics in Tables 1 and 2. First-years were considered eligible as long as they were enrolled in the introductory psychology course, PSY100, and had declared intent to apply for admission to a major or specialist program in psychology.[2] They were recruited internally in exchange for course credit. Fourth-years were recruited by word of mouth and were not compensated. The study was granted ethical approval by the Department of Psychology's internal Ethics Review Committee.

[2] The University of Toronto permits students to enter programs of study only in their second year of study. Together with a credit and breadth requirement, the completion of any program at the "specialist" level satisfies the graduation requirements; a "major" must be accompanied by a second "major," or by two "minors."

The fourth-years were all students in the psychology "research specialist" program, a limited-enrolment departmental offering requiring competitive admission. These students are given additional opportunities for course-based lab work, professional development, and advanced theoretical discussion. Accordingly, they are arguably the most highly-trained disciplinary apprentices of psychology at the University of Toronto. This was one reason for selecting them as an interview group: they ought to best reflect the adopted disciplinary lens. The other reason was, again, reflexive: the first author belonged to this same class of students. The first author and the twelve fourth-years interviewed together comprised the year's entire cohort of research specialists, whose expressions of ambivalence inspired this study.

The cross-sectional comparison of the same year's first-year students and fourth-year research specialists was useful for several reasons. As we will describe, stark differences were apparent between the groups in the effects of their education. Because the study is not longitudinal, however, these differences may be attributable to causes other than disciplinary transformation. These include selection effects pertaining to who is admitted into the research specialist program, who "survived" to complete their fourth year after enduring the COVID-19 disruption of undergraduate education, and who were especially candid in their interview responses because of a trusting familiarity with the first author. Even so, this qualitative group comparison is at least suggestive of the selection of "successful" psychological apprentices, if not also their change over time. Another benefit of using consecutively interviewed groups was the opportunity to apply unexpected themes and concerns expressed by first-years to the interviews with fourth-years, allowing for targeted comparative exploration of responses.

Interviews for both groups were semi-structured (see Appendix for the guides). In each case, the final version of the guide is shown, as they were altered slightly through the course of interviews to highlight unexpected, emerging themes. After obtaining written consent, we interviewed each student individually with a voice recorder. First-year interviews lasted 25 minutes on average, and fourth-year interviews lasted 40 minutes on average. The time difference reflected the capacity of fourth-years to discuss their extended experience in the discipline for longer and with more substantive detail. The first-year interviews were completely transcribed and analyzed before beginning the fourth-year interviews.

Thematic analysis

All interviews were transcribed and manually corrected, constituting the data familiarization phase of TA. Using NVivo qualitative data analysis software, we referentially coded the statements made in each transcript, resulting in 77 distinct codes for the first-year interviews and 105 for the fourth-year interviews. These were organized into higher-level knowledge domains (e.g., codes "psychology applies to my everyday life" and "psychology does not apply to my everyday life" were combined under the domain, "applicability of psychology to everyday life"). We integrated the most salient knowledge domains – those which strongly or frequently characterized our understanding of participants' views – into themes: clusters of meaning underlying participants' statements. The themes which we interpreted from the first-year interviews (see results below) were directly incorporated into questions for the fourth-year interviews (see Appendix).

Results

First-years

The first-year interviews (participant IDs P1-1 through P1-19; see Table 1) served to generate unexpected themes or expectancies for the fourth-year interviews, as well as to establish a profile of the "novice" whose development into an "experienced" student researcher was of interest. In brief, first-years expressed a relatively confident view about the power of psychology and psychological explanation, though they disagreed about the value and relevance of its knowledge. They were aware of issues hampering the field, but not daunted by them. The following themes emerged.

Table 1
First-year participant demographics

ID	*Age*	*Gender*	*Ethnicity*	*Intended psychology program*
P1-1	18	F	East and Southeast Asian	Major
P1-2	18	F	East and Southeast Asian	Specialist
P1-3	19	M	European	Major
P1-4	18	F	Middle Eastern	Major
P1-5	18	M	East and Southeast Asian	Major
P1-6	18	F	European	Major
P1-7	19	F	East and Southeast Asian	Major
P1-8	21	F	East and Southeast Asian	Major
P1-9	18	F	East and Southeast Asian	Major
P1-10	18	F	Latin, Central, and South American	Major
P1-11	18	M	East and Southeast Asian	Major
P1-12	18	F	European	Major
P1-13	18	NB	European	Major
P1-14	18	F	South Asian	Major
P1-15	18	F	East and Southeast Asian	Major
P1-16	18	F	East and Southeast Asian	Major
P1-17	18	M	European	Major
P1-18	19	F	European	Major
P1-19	20	M	East and Southeast Asian	Major

Psychology gives us narratives of our being and our suffering.

P1-4: "I want to be able to take a person and understand what they're going through and how they came to be that sort of way, came to think that sort of way.

P1-1: "I just want to be able to understand mental illnesses deeper, so it doesn't just help me, but other people as well."

Most first-years expressed their attraction to the field of psychology along one of the two lines exemplified by the above quotes: explaining the causes of a person's dispositional state of mind, or hoping to provide care for people suffering from psychological distress, especially out of empathy inspired by having undergone the same suffering.

The element of *narrative* is notably salient in both cases. First-years tended not to think of behavioural or clinical explanation in strictly descriptive or causal terms. They often spoke in terms of development, life histories, or hidden pasts that might give meaning or context to the visible present. The attraction of psychology for many of the novices was in revealing this layer of meaning, whether in more detached terms or because of a personal, often troubling awareness of such layers underlying one's own outward presentation.

Psychological explanation makes us sympathetic and gives us control. Most first-years did not see psychology's explanatory power simply as a tool for pursuing their curiosity or compassionate motives. They felt that it would also *alter* their perspective:

P1-15: "I feel like when you study psychology, you become a more empathetic person. It's just understanding that a lot of the way we behave is coming from the way we think. I feel like I'm better able to kind of put myself in [others'] shoes.

Like P1-15, many first-years used the word "empathy" in connection with psychological explanation, but their descriptions of how it works – by grasping the hidden causal or narrative mechanisms underlying behaviour – suggest that sympathetic understanding is what they actually meant. By learning the psychological perspective, first-years hoped to be able to demystify and dispassionately identify the causes of behaviour, especially irrational behaviour, rather than reacting personally or emotionally.

First-years sometimes expressed the source of their hoped-for sympathy in explicitly deterministic terms: knowing that behind someone's behaviour was not "them" or "their fault," but some situational factor. Some first-years successfully internalized this view, seeing their own faults or eccentricities as situational. Others, however, perceived a conflict between psychology's determinism and belief in their own agency, and conceded that though psychology had begun to change their views on others' behaviour, they continued to judge their own behaviour as the result of moral agency.

Academic psychology's relevance to everyday life can be unclear or doubtful. Some first-years, like those who described becoming more understanding or sympathetic toward others, perceived psychological training as already broadly relevant to everyday life. But while keen to apply the psychology they learned to their own lives, they could not see how to do so. They hoped

to be taught how in future courses. Others characterized psychology as relevant outside of class only insofar as it provides new labels for familiar phenomena:

> P1-2: "[Psychology's] not helpful. It's not harmful. If you have a friend who also studies psychology, we're like 'oh, this is called blah blah blah. This is "tip of the tongue,"' or something like that. This is funny, but how does it really help me?"

Notably, a lack of personal relevance did not interfere with first-years' interest in psychology in most cases. Either they had a strong research or professional orientation, and were content to explore academic psychology as a "pure" field of knowledge, or hoped that their later learning would shift to areas of psychology that *had* been personally meaningful to them in the past, such as psychoanalysis.

Psychology is only partly scientific. Most first-years viewed biological psychology as a "hard" science. Other areas of psychology, such as social, cultural, and clinical, were seen as a different sort of study, more of an "art" or other practice too "subjective" to qualify as real science. Cognitive psychology, considered science by some but not others, occupied a disputed middle ground. This questionable scientific status was not seen as worrying. Some first-years saw a more "artistic" psychology as a necessary and valuable complement to its more "scientific" side:

> P1-13: "Physics provides one perspective. You could argue it's the most fundamental of the sciences. And if you take psychology, I think that's probably the most upper level. … So taking two dramatically different approaches could give me some knowledge that complements each other."

Other first-years did prescribe a fully "scientific" psychology as the future ideal. They reasoned that psychology's present, questionably scientific status could be explained by its youth, and that the field would eventually develop into a full-fledged science.

Psychological knowledge is historical. Most first-years reasoned that psychological research will never totally capture its object, human behaviour. P1-18 described psychology as a field that must always be "updated," as "people are always evolving, and the world is always evolving." Thus, its knowledge is historically contingent, describing a particular population at a particular time, not general laws of behaviour. However, again, most first-years distinguished the field of biological psychology as a "hard" science capable of generating ahistorical knowledge.

Psychology's major problem is sampling bias. About half of the first-years had some prior knowledge of the replication crisis. Most who perceived a problem in the field expressed it in terms of sampling bias, or the "WEIRD" problem (Henrich et al., 2010). That is, they were relatively confident as a group that movement toward more inclusive sampling, though practically difficult, would eventually resolve the major issues limiting the reliability and generalizability of psychological findings.

Some first-years dissented from this view, citing various factors that, according to them, are ineradicable in psychological research. These included the historical contingency of psychological knowledge (see above), the inherent subjectivity of theories, and the practical impossibility of sampling to a level sufficient to mitigate sampling bias.

Fourth years: Psychology research specialists

The fourth-year interviews included participant IDs P4-1 through P4-12 (see Table 2). The main themes of these interview were affective in nature. Specifically, the research specialists overwhelmingly expressed feelings of dejection, alienation, and frustration with the state of psychological research and the questionable value of its findings. This result was twice-unexpected, given the rather confident attitudes of the first-years and the authors' prior expectation that the research specialists would constitute the most highly disciplined "believers" in the truth claims of their discipline. The more specific substantive themes that emerged are described below.

Table 2
Fourth-year research specialist participant demographics

ID	*Age*	*Gender*	*Ethnicity*
P4-1	21	F	European
P4-2	21	F	European
P4-3	23	M	East and Southeast Asian
P4-4	23	F	European
P4-5	22	F	East and Southeast Asian
P4-6	22	M	European
P4-7	21	F	South Asian
P4-8	21	M	European
P4-9	21	F	European
P4-10	21	M	East and Southeast Asian
P4-11	21	F	European
P4-12	23	F	South Asian

Note. Participants P4-1 through P4-12, together with the researcher (age 21, male, East Asian), comprised a full cohort of psychology research specialists. According to participants' self-identified subfields, the class comprised 5 in social psychology, 2 in autism research, 2 in computational psychology, 1 in cognitive psychology, 1 in cognitive neuroscience, and 1 in developmental psychology. These demographics are reported in aggregate to avoid possible identification of participants within the class.

Psychology research has numerous serious problems. Three issues cited by more than half of the fourth-years were poor generalizability of findings, the insularity of the discipline, and lack of qualitative work.

> P4-3: "I think generality is a key issue, at least compared to other natural science fields. It may also influence the public image of psychology, and the funding and other stuff. And if the finding is of little generality, I think we researchers ourselves may even doubt our own value."

Several fourth-years explicitly mentioned Tal Yarkoni's paper on the "generalizability crisis" (2022), which had been read in a research specialist seminar, in explaining their concerns. According to this view, severe limits on generalizability plague almost all contemporary psychological studies due to their methodological conventions, rendering them of little meaning.

Insularity concerned the fourth-years for several reasons. Some felt that psychological findings remain inaccessible to the public or are presented in a way that encourages misinterpretation. Others argued that psychologists do not incorporate diverse or critical perspectives in their work, especially in subfields that focus on marginalized groups. Some critiqued the splintering effect of the open science framework, which advantages contributions by elite Western institutions, rather than pursuing the real goal of methodological critique.

The relative absence of qualitative or participatory action research in prestigious journals, according to many fourth-years, is symptomatic of deep-rooted ethical and epistemological biases. Some fourth-years who were conducting research on marginalized populations noted how an uncritical acceptance of "value-free" quantitative methodological conventions often serves to perpetuate imbalances of power: the researcher interprets the subject, but the subject may not speak. More generally, many fourth-years criticized the methodological inertia of the field, which reuses methods based on outdated beliefs "without putting any additional thought into why we're using these in the first place," according to P4-9.

Psychological theories are incoherent because they ignore narrative and history.

P4-6: "Something that I really feel like I'm lacking going into graduate school is a sense of the history of cognitive science, which I've been really trying to catch up on: how ideas have developed, how ideas have conflicted, and how we keep coming back to the same ideas in cycles of 20-30 years. And I think that that's a really major problem that I see beyond the meta-science or methodological problems."

P4-8: "I think a narrative focus allows you to apply these theories to your own life, to your own experience, in a way that receiving a list of facts can't. Receiving a list of facts, you're going to be hard pressed to integrate that into your understanding of the world, because we don't really think in terms of lists of facts. We think in terms of stories, in terms of narratives. Who am I, according to me, right now? I think other fields fit much more easily into human experience, in a way that psychology proper never really has."

Many fourth-years used the same descriptor as P4-8, "a list of facts," to describe their psychology education. They felt that the fear of narrativizing or historicizing our findings and our theories, which might undercut their scientific appearance, renders the field incoherent both internally and with respect to lived experience.

On the whole, psychology is irrelevant and inapplicable. While the fourth-years expressed similar initial attractions to psychology as the first-years – explaining behaviour and helping people – most reached the conclusion that their learning and research did not apply as much as they had hoped outside the lab. The findings were too basic, applied only to a narrow sample, or were already intuitive. Notably, this was also true for what the first-years perceived to be a salient

effect of psychological training on their social lives: the capacity to be more sympathetic and less judgmental. Fourth-years largely rejected this notion:

> P4-9: "I think that's not necessarily thinking like a psychologist. It's just having empathy and being able to understand that other people are separate entities from yourself. It's not really unique to psychology."

> P4-2: "That's not just psychology. It's also just growing up."

On a broader scale, fourth-years were doubtful about psychology's capacity to produce useful interventions based on its knowledge, due to the poor generalizability of its results. Indeed, P4-10 noted his "pessimistic view of psychology," in that "often the interventions we create are … ridiculous, the kind of thing you would only do in an experimental setting." In his view, material or economic interventions would be far more effective in most cases.

But a few fourth-years expressed a decidedly more positive view. They saw their scientific training as broadly relevant in having increased their tolerance for a diversity of viewpoints, and certain theories as instructive for making decisions in their personal lives. Some judged themselves to have become more "rational" after training in psychology.

Psychological knowledge is not objective, though we claim it is. While a couple of fourth-years held to strict positivist views of knowledge, two-thirds of the fourth-years expressed strong constructivist views, seeing measurement and interpretation as bound to cultural and historical context. They also emphasized the subjectivity of the researcher:

> P4-1: "I definitely agree with the perspective that there is no such thing as value-free science. There is no such thing as objective science. Every single person that's doing the science is biased and has values."

> P4-4: " All researchers have identities and subjectivities, so it makes no sense to not have a place for it. We might as well just ignore half of what motivates us to do research."

Unlike the first-years, fourth-years denied that biological psychology was immune to these critiques. "People who think that cognitive neuroscience, even neuroscience itself, is immune to these things – yeah, they're fooling themselves," stated P4-6. The research specialists used words like "compensation" (P4-7), "pretending" (P4-8), "façade" (P4-11), and "made-up" (P4-12) to describe psychology's continued commitment to presenting as a purely objective science.

Research specialists felt disillusioned by specific grievances, but encouraged by vague hopes. The class of research specialists unanimously reported feelings of dejection and powerlessness within their field. These varied from resignation (P4-4: "There's still a sense of, 'shit, this all sucks,' but it's fine if it does. I don't see a better alternative for me to get answers to my questions.") to anger (P4-7: "The only reason I want to go to grad school is spite for the way things are done. I hate this shit, so I want to do something else. It's making it really hard to find supervisors.") to total cynicism:

> P4-12: "I don't know what it is like to think like a psychologist. I feel like it's like a made-up thing. I think people just find the easiest way to accomplish this very specific thing, so that they can write up a paper. They just make up some shit up and put some garbage out. I think it's mostly garbage. It's like a little game that we all play: how can we

> accomplish this little thing? And then we can write this little thing in our CV. It's essentially meaningless.

A particularly salient grievance among the research specialists was a sense of involuntary hypocrisy. As P4-8 puts it, "We've been talking about its arbitrariness and all the kinds of problems that [psychology] has. And then I found myself designing and running a study that completely ignores all of my concerns, and so I'm kind of living in some state of cognitive dissonance." Several fourth-years felt powerless to raise their critiques with their supervisors, or they felt that supervisors themselves were powerless to address them against the field's incentive structure.

In many cases this alienation was expressed as disillusionment. Several fourth-years mentioned a "naïve perspective" (P4-1) they held toward the power of psychology in first year: "But I think that [it has] failed me in in actually providing me applicable things, and maybe I don't seek that as much anymore" (P4-6).

Many fourth-years did report compensating facets of the field of psychology which encouraged them, but these feelings were less well-defined than the grievances they expressed. For instance, some cited the youth of the field and the hope that it will "outgrow" the problems of a fledgling science. Others described the adoption of more advanced quantitative methods, such as Bayesian analysis, or the more stringent application of measures like preregistration as "steps in the right direction." But the direction of growth and improvement was unclear, with some participants citing greater future objectivity, reliability and precision, and others more acceptance of qualitative methods over quantitative analysis.

Discussion

The results bear on our questions of disciplinary epistemology and pedagogical ethics in several ways. The most striking finding was the dejection expressed by most of the research specialists. Recall that these are the most highly trained, competitively selected undergraduate apprentices in the university's psychology department. They might be expected to be most influenced by and committed to the values of the field. But while fourth-years were clearly conversant with these values, they were disillusioned by them and noncommittal at best in adopting them.

This would seem to suggest that the effect of the replication crisis "on the ground" has not so much been to alter our epistemological commitments as to dissolve the confidence with which disciplinary knowledge can be justified. The majority of fourth-years, unlike their first-years counterparts, rejected the possibility of a purely objective psychological science in any of its subfields. Many critiqued the dominance of the quantitative paradigm that purports to champion objective knowledge production (Nosek et al., 2012). But no unified picture emerged from the fourth-years in terms of what methodological alternative, if any, might replace the existing one. Many felt discouraged or silenced when trying to suggest alternatives to their supervisors or questioning the requirements of journal publication. It is hard to avoid the conclusion that disciplinary training has produced apprentices who doubt aspects of their creed, at least some of its core assumptions and commitments, yet feel constrained from exploring constructivist, participatory, or other forms of knowledge production.

Through their education, the research specialists have achieved a degree of critical theoretical awareness but feel unable to apply this awareness on a practical or methodological level. This may be broadly reflective of the nature of psychology's meta-critique during the

replication crisis. Several analyses of psychology's response to its crisis have shown that, while psychologists have been open to statistical reform, they have mostly ignored or excluded theoretical and philosophical critiques that could fundamentally modify or diversify its "indigenous epistemology" (Maiers, 2022; Morawski, 2019; Wiggins & Christopherson, 2019). The research specialists' disaffected response to this exclusivity could be reflected in this study.

From the perspective of epistemological development, the research specialists might be interpreted to have stopped short of Perry's (1968) terminal stage of epistemological commitment. Alternatively, their responses can be evaluated as at best in line with relativism, the stage preceding commitment, or with multiplicity, two stages preceding. Indeed, Perry (1968) describes two forms of the stance of multiplicity as "rebellion" and "playing the game," both indicating a lack of confidence in officially given disciplinary standards. This is much in line with the responses of the present participants. This regression to a less "sophisticated" form of epistemology is typically associated, in research following Biglan (1973), with "hard" rather than "soft" sciences. In this case, however, it seems justified to challenge the assumptions of both frameworks to make sense of the results. The relatively "undeveloped" epistemological stance reflected in the comments of the research specialists indicates not a lack of nuanced philosophical consideration but rather a view of psychology as offering a problematic and naïve epistemology, to which it is best to respond pragmatically with acceptance. Again, it was precisely psychology's overconfidence in its characterization as a "hard science" that provoked the research specialists to harbour epistemological doubts that are more typically voiced by critics within the humanities (Karimi, 2014).

Viewed from the lens of pedagogical ethics, these results suggest that a more serious engagement with critical education is needed in psychology. Critical pedagogy, broadly, is concerned with the emancipation of the student from rigid perspectives, the cultivation of her individual subjectivity, and the legitimation of voices traditionally deprived of agency (Giroux, 2020; McLaren, 2002). These aspects speak to the experience of many of the psychology students interviewed for this study. Overwhelmingly, the results revealed a sense of limited agency and of involuntary bondage to the approaches and attitudes favoured by supervisors or funding and credentialing systems. These disciplinary commitments seemed at times contrary to what many students felt was more justified and relevant to enriching their lives. Instructors, research supervisors, and administrators would do well to critically examine the disciplinary practices that might be contributing to the doubts and disappointment of students, and focus as much on their personal growth and confidence as moral agents as on their technical capacities as scientists.

Psychologists and instructors outside of the University of Toronto's Department of Psychology should also, we argue, recognize this urgency. Though the narrowness of pedagogical research in psychology limits our insight into students at other universities, the present results offer at least an unsettling case study on the product of psychological education at one prestigious North American institution. Given the research specialists' attribution of many of their grievances not to the local departmental culture but to the ethos of scientific psychology as a discipline, the results may have broader import. The question of which disciplinary features and practices led to the predicament of this cohort, and how they might be avoided or improved, is a far-reaching one.

But where could more space for critical reflection and action – especially the empowerment of an alienated student cohort – be made at the pedagogical level? The results suggest that changes on both a cultural and a curricular level might be helpful. A disciplinary culture that inadvertently leaves students feeling stifled and silenced should be challenged. Yet, as some fourth-years

reported, some of the suppression they experienced was symptomatic of broader funding and reward imperatives in the field of psychology. Too many supervisors, fearing reputational cost either to themselves or their trainees, discouraged open discussion of methods and orientations that were not mainstream. But teachers bear an ethical responsibility to provide advanced students with spaces to voice concerns, pursue critiques, and, where possible, translate their concerns into productive research activity. Individual supervisors do have the power at least to engage earnestly with methodological and philosophical alternatives that students propose for consideration.

On a curricular level, we suggest that teaching in psychology should incorporate reflexive critique and opportunities for emotional openness and honesty, alongside the existing, more practical treatment of the replication crisis. Since the fourth-years often expressed their alienation in terms of a disillusionment or a reckoning with long-latent resentments, we should question why they felt that illusions about the field persisted so long in their education. Could space be made in introductory and intermediate courses not just for showcasing key studies and findings but also voicing personal doubts and exploring marginal perspectives? Could dedicated courses be offered to provide students with the philosophical and critical vocabulary to articulate and develop their intuitions and concerns rather than letting them fester into resentments?

These pedagogical steps cannot themselves resolve the deep-rooted epistemological muddle of psychology. But they might prevent or mitigate the malaise that characterized too many of the fourth-year students in this study. This might also produce more confident students, emboldened to enter the discipline and work for change.

Unfavorable public opinion toward psychology as a result of the replication crisis has been much-discussed (e.g., Hendriks et al., 2020; Mede et al., 2021; Wingen et al., 2020). This study suggests that a corrosion of confidence has also occurred from within the discipline. Notably, a previous study that examined undergraduate students' responses to a short lecture on replication issues noted the "worrisome" finding that "students reported trusting the studies of psychologists slightly less," yet concluded nonetheless that "the recent discussions about replication will not cause a shortage in graduate school applicants anytime soon—at least as long as students learn about it in an even-handed way from their instructor" (Chopik et al., 2018). Though we agree that the finding is worrisome, particularly in the context of the present study where the erosion of trust is more than "slight," we would question the authors' recommendations. Instructors ought not to shelter students from critique by purveying an artificially soft-pedalled view of the replication crisis. This inevitably focuses discussion on widely-accepted statistical and methodological reforms and deters more trenchant philosophical and critical questioning. Moreover, the overriding focus on preserving a steady stream of professionalized graduate school applicants rather than engaging with their deeply felt misgivings is a deflection that our fourth-years clearly recognized and denounced. In some cases it did in fact weaken their commitment to graduate education in psychology.

While we have argued that the findings of this study bear relevance beyond a single university department, the limitations of the cohorts interviewed deserve some mention. Our initial expectation – that the research specialists, due to their intensive disciplinary training and selection, would be especially committed to the values of the field – was disconfirmed. Their intimate familiarity with research practices appeared to generate significant doubts about psychology. These doubts were then developed and articulated through structured opportunities for theoretical consideration that are unique to the research specialist program. Thus, the dissonance between theoretical misgivings and actual practice may be crucial to understanding the alienation expressed

in the interviews. But what of the psychology majors and other non-research-specialists in the department who have both less practical research experience and limited opportunity for critical reflection? If interviewed, they might not have expressed the same concerns highlighted in this study, or at least not to the same extent.

After what might seem a rather pessimistic discussion, we would like to end on a note of optimism. It is encouraging that an entire cohort of senior-year research specialists exhibited the courage and independence of thought to interrogate the practices and commitments of their own science – and were able to imagine new possibilities. Their critical questioning was clearly a source of subjective tension, but it was a creative and productive tension, one that could help animate a discipline that is arguably in crisis. It would therefore be wrong to view these students as problematic. On the contrary, they may represent our best hope for improving our science.

References

Ashwin, P., Abbas, A., & McLean, M. (2014). How do students' accounts of sociology change over the course of their undergraduate degrees? *Higher Education*, *67*(2), 219–234. https://doi.org/10.1007/s10734-013-9659-z

Barger, M. M., Perez, T., Canelas, D. A., & Linnenbrink-Garcia, L. (2018). Constructivism and personal epistemology development in undergraduate chemistry students. *Learning and Individual Differences*, *63*, 89–101. https://doi.org/10.1016/j.lindif.2018.03.006

Biglan, A. (1973). Relationships between subject matter characteristics and the structure and output of university departments. *Journal of Applied Psychology*, *57*(3), 204–213. https://doi.org/10.1037/h0034699

Borgerding, L. A., Deniz, H., & Anderson, E. S. (2017). Evolution acceptance and epistemological beliefs of college biology students. *Journal of Research in Science Teaching*, *54*(4), 493–519. https://doi.org/10.1002/tea.21374

Boyatzis, R. E. (1998). *Transforming qualitative information: Thematic analysis and code development*. SAGE.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Braun, V., & Clarke, V. (2019). Reflecting on reflexive thematic analysis. *Qualitative Research in Sport, Exercise and Health*, *11*(4), 589–597. https://doi.org/10.1080/2159676X.2019.1628806

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, *18*(1), 32–42. https://doi.org/10.3102/0013189X018001032

Chopik, W. J., Bremner, R. H., Defever, A. M., & Keller, V. N. (2018). How (and whether) to teach undergraduates about the replication crisis in psychological science. *Teaching of Psychology*, *45*(2), 158–163. https://doi.org/10.1177/0098628318762900

Corte, U., & Irwin, K. (2017). The Form and flow of teaching ethnographic knowledge: Hands-on approaches for learning epistemology. *Teaching Sociology*, *45*(3), 209–219. https://doi.org/10.1177/0092055X17697771

Domert, D., Airey, J., Linder, C., & Kung, R. L. (2007). An exploration of university physics students' epistemological mindsets towards the understanding of physics equations. *Nordic Studies in Science Education*, *3*(1), Article 1. https://doi.org/10.5617/nordina.389

Edelman, L. (2004). *No future: Queer theory and the death drive*. Duke University Press.

Elby, A. (2001). Helping physics students learn how to learn. *American Journal of Physics*, *69*(S1), S54–S64. https://doi.org/10.1119/1.1377283

Foucault, M. (1995). *Discipline and punish: The birth of the prison*. Vintage.

Gergen, K. J. (1985). The social constructionist movement in modern psychology. *American Psychologist*, *40*, 266–275. https://doi.org/10.1037/0003-066X.40.3.266

Giroux, H. (2020). Critical pedagogy. In U. Bauer, U. H. Bittlingmayer, & A. Scherr (Eds.), *Handbuch Bildungs- und Erziehungssoziologie* (pp. 1–16). Springer Fachmedien. https://doi.org/10.1007/978-3-658-31395-1_19-1

Goedeke, S., & Gibson, K. (2011). What do new psychology students know about psychology? *Australian Psychologist*, *46*(2), 133–139. https://doi.org/10.1111/j.1742-9544.2011.00028.x

Halloun, I. A., & Hestenes, D. (1985). The initial knowledge state of college physics students. *American Journal of Physics*, *53*(11), 1043–1055. https://doi.org/10.1119/1.14030

Hendriks, F., Kienhues, D., & Bromme, R. (2020). Replication crisis = trust crisis? The effect of successful vs failed replications on laypeople's trust in researchers and research. *Public Understanding of Science*, *29*(3), 270–288. https://doi.org/10.1177/0963662520902383

Henrich, J., Heine, S. J., & Norenzayan, A. (2010). Beyond WEIRD: Towards a broad-based behavioral science. *Behavioral and Brain Sciences*, *33*(2–3), 111–135. https://doi.org/10.1017/S0140525X10000725

Hiley, B., & Peat, F. D. (2012). *Quantum implications: Essays in honour of David Bohm*. Routledge.

Hook, D. (2004). *Critical psychology*. Juta and Company Ltd.

Kaartinen-Koutaniemi, M., & Lindblom-Ylänne, S. (2008). Personal epistemology of psychology, theology and pharmacy students: A comparative study. *Studies in Higher Education*, *33*(2), 179–191. https://doi.org/10.1080/03075070801916088

Kaartinen-Koutaniemi, M., & Lindblom-Ylänne, S. (2012). Personal epistemology of university students: Individual profiles. *Education Research International*, *2012*, e807645. https://doi.org/10.1155/2012/807645

Karimi, M. N. (2014). Disciplinary variations in English domain-specific personal epistemology: Insights from disciplines differing along Biglan's dimensions of academic domains classification. *System*, *44*, 89–100. https://doi.org/10.1016/j.system.2014.03.002

King, N., & Brooks, J. M. (2017). *Template analysis for business and management students*. SAGE Publications Ltd. https://doi.org/10.4135/9781473983304

Landa-Blanco, M., & Cortés-Ramos, A. (2021). Psychology students' attitudes towards research: The role of critical thinking, epistemic orientation, and satisfaction with research courses. *Heliyon*, *7*(12), e08504. https://doi.org/10.1016/j.heliyon.2021.e08504

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral particpation*. Cambridge University Press.

Lising, L., & Elby, A. (2005). The impact of epistemology on learning: A case study from introductory physics. *American Journal of Physics*, *73*(4), 372–382. https://doi.org/10.1119/1.1848115

Maiers, W. (2022). Replication Crisis – Just another instance of the replication of crises in psychology? Historical retrospections and theoretical-psychological assessments. *Review of General Psychology*, *26*(2), 250–260. https://doi.org/10.1177/10892680211033915

Mazzarone, K. M., & Grove, N. P. (2013). Understanding epistemological development in first- and second-year chemistry students. *Journal of Chemical Education*, *90*(8), 968–975. https://doi.org/10.1021/ed300655s

McLaren, P. (2002). Critical pedagogy: A look at the major concepts. *Education Faculty Books and Book Chapters*. https://digitalcommons.chapman.edu/education_books/85

Mede, N. G., Schäfer, M. S., Ziegler, R., & Weißkopf, M. (2021). The "replication crisis" in the public eye: Germans' awareness and perceptions of the (ir)reproducibility of scientific research. *Public Understanding of Science*, *30*(1), 91–102.

Morawski, J. (2019). The replication crisis: How might philosophy and theory of psychology be of use? *Journal of Theoretical and Philosophical Psychology*, *39*, 218–238. https://doi.org/10.1037/teo0000129

Muñoz, J. E. (2009). *Cruising utopia: The then and there of queer futurity*. NYU Press. https://www.jstor.org/stable/j.ctt9qg4nr

National Center for Education Statistics. (2022). *Undergraduate degree fields*. National Center for Education Statistics. https://nces.ed.gov/programs/coe/indicator/cta

Nosek, B. A., Spies, J. R., & Motyl, M. (2012). Scientific utopia: II. Restructuring incentives and practices to promote truth over publishability. *Perspectives on Psychological Science*, *7*(6), 615–631. https://doi.org/10.1177/1745691612459058

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, *349*(6251), aac4716. https://doi.org/10.1126/science.aac4716

Perry, W. G. (1968). *Forms of intellectual and ethical development in the college years: A scheme. Jossey-Bass Higher and Adult Education Series*. Jossey-Bass Publishers.

Grove, N. P., & Bretz, S. L. (2010). Perry's scheme of intellectual and epistemological development as a framework for describing student difficulties in learning organic chemistry. *Chemistry Education Research and Practice*, *11*(3), 207–211. https://doi.org/10.1039/C005469K

Pieschl, S., Stahl, E., & Bromme, R. (2008). Epistemological beliefs and self-regulated learning with hypertext. *Metacognition and Learning*, *3*(1), 17–37. https://doi.org/10.1007/s11409-007-9008-7

Ralston, K. (2020). 'Sociologists shouldn't have to study statistics': Epistemology and anxiety of statistics in sociology students. *Sociological Research Online*, *25*(2), 219–235. https://doi.org/10.1177/1360780419888927

Richardson, J. T. E. (2013). Epistemological development in higher education. *Educational Research Review*, *9*, 191–206. https://doi.org/10.1016/j.edurev.2012.10.001

Ritchie, J., & Spencer, L. (1994). Qualitative data analysis for applied policy research. In A. Bryman & R. G. Burgess (Eds.), *Analyzing qualitative data* (pp. 173–194). Taylor & Francis. https://doi.org/10.4324/9780203413081_chapter_9

Rosman, T., Peter, J., Mayer, A.-K., & Krampen, G. (2018). Conceptions of scientific knowledge influence learning of academic skills: Epistemic beliefs and the efficacy of information literacy instruction. *Studies in Higher Education*, *43*(1), 96–113. https://doi.org/10.1080/03075079.2016.1156666

Roth, W., & Roychoudhury, A. (1993). The nature of scientific knowledge, knowing and learning: The perspectives of four physics students. *International Journal of Science Education*, *15*(1), 27–44. https://doi.org/10.1080/0950069930150103

Roth, W.-M., & Lucas, K. B. (1997). From "truth" to "invented reality": A discourse analysis of high school physics students' talk about scientific knowledge. *Journal of Research in Science Teaching*, *34*(2), 145–179. https://doi.org/10.1002/(SICI)1098-2736(199702)34:2<145::AID-TEA4>3.0.CO;2-T

Ruti, M. (2017). *The Ethics of Opting Out: Queer Theory's Defiant Subjects*. Columbia University Press. https://doi.org/10.7312/ruti18090

Sandoval, W. A., & Morrison, K. (2003). High school students' ideas about theories and theory change after a biological inquiry unit. *Journal of Research in Science Teaching*, *40*(4), 369–392. https://doi.org/10.1002/tea.10081

Schommer-Aikins, M., Duell, O. K., & Barker, S. (2003). Epistemological beliefs across domains using Biglan's classification of academic disciplines. *Research in Higher Education*, *44*(3), 347–366. https://doi.org/10.1023/A:1023081800014

Schraw, G., & Sinatra, G. M. (2004). Epistemological development and its impact on cognition in academic domains. *Contemporary Educational Psychology*, *29*(2), 95–102. https://doi.org/10.1016/j.cedpsych.2004.01.005

Sebidi, K., & Morreira, S. (2017). Accessing powerful knowledge: A comparative study of two first year sociology courses in a South African university. *Critical Studies in Teaching and Learning (CriSTaL)*, *5*(2), 33–50. https://doi.org/10.14426/cristal.v5i2.87

Shrout, P. E., & Rodgers, J. L. (2018). Psychology, science, and knowledge construction: Broadening perspectives from the replication crisis. *Annual Review of Psychology*, *69*(1), 487–510. https://doi.org/10.1146/annurev-psych-122216-011845

Soyyılmaz, D., Griffin, L. M., Martín, M. H., Kucharský, Š., Peycheva, E. D., Vaupotič, N., & Edelsbrunner, P. A. (2017). Formal and informal learning and first-year psychology students' development of scientific thinking: A two-wave panel study. *Frontiers in Psychology*, *8*. https://www.frontiersin.org/articles/10.3389/fpsyg.2017.00133

Stoecker, J. L. (1993). The Biglan classification revisited. *Research in Higher Education*, *34*(4), 451–464. https://doi.org/10.1007/BF00991854

Teo, T. (2010). What is epistemological violence in the empirical social sciences? *Social and Personality Psychology Compass*, *4*(5), 295–303. https://doi.org/10.1111/j.1751-9004.2010.00265.x

Teo, T. (2018). Homo neoliberalus: From personality to forms of subjectivity. *Theory & Psychology*, *28*(5), 581–599. https://doi.org/10.1177/0959354318794899

Vhurumuku, E. (2011). High school chemistry students' scientific epistemologies and perceptions of the nature of laboratory inquiry. *Chemistry Education Research and Practice*, *12*(1), 47–56. https://doi.org/10.1039/C1RP90007B

von Glasersfeld, E. (1985). Reconstructing the concept of knowledge. *Archives de Psychologie*, *53*, 91–101.

Wallace, C. S., Tsoi, M. Y., Calkin, J., & Darley, M. (2003). Learning from inquiry-based laboratories in nonmajor biology: An interpretive study of the relationships among inquiry experience, epistemologies, and conceptual growth. *Journal of Research in Science Teaching*, *40*(10), 986–1024. https://doi.org/10.1002/tea.10127

West, E. J. (2004). Perry's legacy: Models of epistemological development. *Journal of Adult Development*, *11*(2), 61–70. https://doi.org/10.1023/B:JADE.0000024540.12150.69

Wiggins, B. J., & Christopherson, C. D. (2019). The replication crisis in psychology: An overview for theoretical and philosophical psychology. *Journal of Theoretical and Philosophical Psychology*, *39*, 202–217. https://doi.org/10.1037/teo0000137

Wingen, T., Berkessel, J. B., & Englich, B. (2020). No replication, no trust? How low replicability influences trust in psychology. *Social Psychological and Personality Science*, *11*(4), 454–463. https://doi.org/10.1177/1948550619877412

Yarkoni, T. (2022). The generalizability crisis. *Behavioral and Brain Sciences*, *45*, e1. https://doi.org/10.1017/S0140525X20001685

Zwickl, B. M., Hirokawa, T., Finkelstein, N., & Lewandowski, H. J. (2014). Epistemology and expectations survey about experimental physics: Development and initial results. *Physical Review Special Topics - Physics Education Research*, *10*(1), 010120. https://doi.org/10.1103/PhysRevSTPER.10.010120

Appendix

First-year interview guide

1. Since you're taking PSY100, I assume you have some interest in psychology. Can you tell me about why you enrolled in this course?
    a. How does psychology fit into the picture with your other (prospective) majors?
    b. What about learning psychology attracted you to test out this course?
2. What do you think so far? Are there some parts of your classes that you've really liked or disliked?
    a. Which area has interested you most so far?
    b. Do you think some parts of what you learn are more useful to you than others?
3. What do you think you'll learn through studying psychology?

    a. What do you think you'll know more about?
    b. What do you think you'll be able to do that you can't do now?
    c. Do you think you'll be able to do some things better?
    d. Have you started to use what you've learned outside of the classroom?
4. How do you think these kinds of knowledge will change how others see you?
    a. How others treat you / how you treat others?
    b. How might it change how you see yourself? Has your class so far already changed this?
5. Do you think what you learn might turn out to be wrong in the future?
    a. Might what you learn be true now, but false later, as people and society change?

Fourth-year interview guide

1. Why did you enroll in psychology?
    a. What were your other majors? How did these fit together in shaping your learning?
2. What is your subfield of psychology? Why are you especially interested in it? How does it tie back to what you wanted / what you were interested in?
3. Others I spoke to noted two main things that attracted them: "figuring people out" and helping others like them. Do these resonate? Is it different than it was?
4. Do you find psychology applicable to your everyday life?
5. Some students feel like psychology makes them less judgmental or more empathetic because more able to explain (away) bad behaviours. How do you feel? If you think back, how did you feel about it / what did you expect?
    a. Is there a tension when applying it to yourself?
6. What do you see as the major problems and ongoing changes in psychology?
7. Do you expect what you've learned now to become false later, as people and society change?
8. In deciding that true/false, what criteria will we use to judge knowledge?
    a. Does that differ from the natural sciences? How do you justify your belief?
    b. Is it universal?
9. Do you think there will be a final psychology?
    a. Differences by subfield?
10. What are your future plans?

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