2023

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frontiers | Frontiers in Education

TYPE Original Research
PUBLISHED 02 February 2023
DOI 10.3389/feduc.2023.982998

OPEN ACCESS

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SPECIALTY SECTION
This article was submitted to Higher Education, a section of the journal Frontiers in Education

RECEIVED 30 June 2022
ACCEPTED 17 January 2023
PUBLISHED 02 February 2023

CITATION
Che ES, Brooks PJ, Schwartz AM, Saltzman ES and Whiteman RC (2023) How do graduate students approach college teaching? Influences of professional development, teaching assistantships, and Big Five personality traits.
Front. Educ. 8:982998.
doi: 10.3389/feduc.2023.982998

How do graduate students approach college teaching? Influences of professional development, teaching assistantships, and Big Five personality traits

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Introduction: Graduate students engage in college teaching with varied attitudes and approaches. Their teaching practices may be influenced by professional development experiences related to pedagogy, and their personality traits.

Methods: Through an online survey of graduate students teaching undergraduate courses (N = 109, 69.7% women, M age = 30 years, 59% psychology), we examined whether self-reported participation in professional development related to pedagogy, teaching assistantship (TA) experience, academic discipline (psychology vs. other), and Big Five personality traits were associated with variation in teaching practices.

Results: Participation in professional development correlated positively with years of undergraduate teaching experience and with the trait of openness. Hierarchical regressions indicated that professional development served to promote student-focused practices and discouraged lecturing, while TA experience (mostly restricted to psychology instructors) promoted lecturing and discouraged a student-focused approach. Regarding academic discipline, psychology instructors gave higher endorsements to an information transmission, teacher-focused approach to teaching, lectured more, and were less likely to provoke debate than instructors of other disciplines. Such differences may be attributed in part to larger enrollments of psychology courses. Regarding personality traits, both openness and agreeableness were associated with some student-focused practices, while conscientiousness was associated with an information transmission, teacher-focused approach and with practices aligned with backward course design.

Discussion: In light of previous evidence that personality traits are malleable, graduate training programs may want to cultivate traits like openness as a means of encouraging graduate students to reflect on their pedagogy and seek ways to improve their teaching through professional development. Relatedly, graduate programs should aim to support students' participation in professional development related to pedagogy and, in doing so, communicate its value.

KEYWORDS

graduate students, teaching assistantship, professional development, Big Five traits, approaches to teaching

1. Introduction

Graduate students are employed as undergraduate instructors at many colleges and universities, both as part of their training and as a means of financial support (Beers et al., 2012). Graduate students' teaching responsibilities vary considerably across institutions (Buskist, 2013). Though some graduate students gain experience as teaching assistants (TA) as an entry to college teaching, many are appointed as instructors of record without prior TA experience and are given full responsibility for teaching one or more courses. TAs generally assist professors with teaching tasks such as grading, tutoring, or leading recitation/laboratory sections. Instructors of record, on the other hand, generally manage all teaching responsibilities and aspects of the course, which may include supervision of TAs (Buskist, 2013). As "professors in training," how graduate students go about teaching has critical influence on future generations of college students. In the present study, we examined links between graduate students' approaches to teaching and their engagement in professional development related to pedagogy, TA experience, and personality traits, as all three of these factors likely influence how graduate students go about teaching. Additionally, given the composition of our sample (over 50% psychology graduate students), we also explored how the teaching practices of graduate students in psychology might differ from their peers in other disciplines.

1.1. Approaches to teaching and related practices

Research on instructional strategies contrasts information transmission, teacher-focused (ITTF) and conceptual change, student-focused (CCSF) approaches to teaching (Trigwell and Prosser, 2004)––the latter also referred to as learning-or learner-centered teaching. While an ITTF approach is lecture-intensive and about direct instruction and content coverage, a CCSF approach utilizes active learning, and encourages problem-solving, collaboration, and provoking debate (Prosser and Trigwell, 2014). Generalizing beyond the CCSF scale, student/learner-focused teaching methods typically emphasize active participation, skills development, student autonomy, teachers and students sharing power, formative assessment practices, and adapting teaching to student needs (Bremner, 2021). ITTF and CCSF approaches are orthogonal dimensions and measured via separate scales (Trigwell and Prosser, 2004). Instructors often combine teaching methods within any given course. While direct instruction may help students grasp key concepts initially (Hattie and Yates, 2014), active learning and guided discovery may encourage higher-order thinking, foster deeper learning over time, increase motivation to learn, and promote persistence in coursework (Cornelius-White, 2007; Alfieri et al., 2011; Freeman et al., 2014).

At the outset of their teaching careers, graduate students often conceptualize college teaching in terms of knowledge transmission but may shift toward greater emphasis on facilitating student learning as they gain teaching experience (Saroyan et al., 2009; Gilmore et al., 2014). In a recent survey of graduate students employed as college instructors (Che et al., 2021), instructors with more than 3 years of teaching experience (median split) reported lecturing to a lesser extent than their counterparts with fewer years of experience. Interpreting this association is difficult, as graduate students who seek out ongoing teaching opportunities may have a predilection for student-focused practices and those who are ineffective teachers may seek out other forms of employment or may not be reappointed. It may also be the case that as graduate students accumulate teaching experience, they encounter more opportunities and incentives to engage in professional development related to pedagogy and, in doing so, develop greater awareness of student-focused practices via exposure to the scholarship of teaching and learning. The present study builds on the previous findings (Che et al., 2021), using unpublished measures taken from the same survey of graduate students and focusing on factors besides years of experience that may influence teaching approaches and practices.

In contrast to an ITTF approach, student-focused teaching emphasizes the importance of getting to know one's students and why they have enrolled in the class (Davidson, 2017; Grose-Fifer et al., 2019). Knowing about students' academic goals and motivations helps instructors make deliberate connections between course material and students' interests (both personal and academic) and build student-faculty rapport (Grose-Fifer et al., 2019). Davidson (2017) also stresses the value of giving students opportunities to exercise choice in crafting course policies and assignments as a means of fostering autonomy and a sense of purpose; such autonomy-supportive teaching practices have been shown to increase intrinsic motivation (Reeve and Cheon, 2021). In the present study, we explored factors related to graduate students' awareness of their students' academic goals and motivations and their attitudes toward student autonomy in the classroom. We also examined graduate students' own sense of autonomy in teaching, under the view that graduate students might lack autonomy and feel pressured to teach in a specified manner in accordance with departmental expectations and procedures, or in a way that imitates practices of supervising faculty.

One aspect of student-focused teaching we included in our survey relates to classroom practices that are inclusive and culturally responsive to students who differ in race, ethnicity, gender, sexual orientation, disability status, age, family income, and in myriad other ways (Dewsbury and Brame, 2019). Inclusive teaching may encompass efforts to decolonize the curriculum and provoke discussions around ethical issues and social justice (North, 2006; Shahjahan et al., 2022). With specific regard to the psychology curriculum, the American Psychological Association (APA) Guidelines for the Undergraduate Psychology Major emphasize the need for students to develop "ethically and socially responsible behaviors for professional and personal settings in a landscape that involves increasing diversity" (American Psychological Association, 2013, pp. 13). For the present study, we adopted items from the Model Teaching Criteria for Psychology (Boysen et al., 2015) that pertained to infusing diversity issues and ethical issues into one's teaching. The Model Teaching Criteria were developed by a Society for the Teaching of Psychology taskforce and align with the APA Guidelines (American Psychological Association, 2013), but are broadly applicable to college and university teaching (Richmond et al., 2016).

In exploring graduate students' approaches to teaching, we also included items from the Model Teaching Criteria related to teaching liberal arts skills (oral and written communication, collaboration, critical thinking, information literacy). Similar to the APA Guidelines (American Psychological Association, 2013), the National Leadership Council for Liberal Education and America's Promise (2008) stresses the importance of developing broad-based transferable skills to help prepare college students for future careers. One approach to documenting students' progress in developing skills involves engaging in backward course design (Wiggins and McTighe, 1998; Davidovitch, 2013), whereby instructors identify measurable learning objectives for their courses (often skills-based), design instruction and assessments with

these objectives in mind, monitor student progress, and use feedback to close gaps between observed learning outcomes and course objectives. Practices analogous to backward course design have been described as a scientist-educator model of teaching (Bernstein et al., 2010; Chew et al., 2018) and are included in the Model Teaching Criteria (Boysen et al., 2015). For the present study, we adopted sets of items related to the use of learning objectives and utilizing feedback, i.e., adjusting one's teaching based on student progress and feedback.

1.2. Effects of professional development and teaching assistantships on approaches to teaching

In the absence of pedagogical training, graduate students may not know about backward course design or the scientist-educator model of teaching, and they may not feel prepared (or even consider it appropriate) to design courses around learning objectives in their role as a graduate student. Instructors often learn about backward course design and other evidence-based practices through professional development programs offered through university teaching and learning centers, at conferences and institutes, and online via blogs and teaching forums (Blush et al., 2020). Professional development related to pedagogy has been shown to increase utilization of student-focused, active-learning strategies among early career faculty (Gibbs and Coffey, 2004; Emery et al., 2020). In general, faculty who invest time and effort to learn about teaching more often have a student-focused approach as compared to those who do not engage in professional development (Manduca et al., 2017; Viskupic et al., 2019). In the present study, we asked whether graduate students who endorse a CCSF approach and use related practices are also more likely to report engagement in professional development related to pedagogy.

Professional development cannot simply be equated with giving graduate students a TA position, where they perform a variety of tasks under the supervision of the instructor of record. In our previous report (Che et al., 2021), we found that graduate students who previously held TA positions prior to becoming an instructor of record gave lower endorsements to a CCSF approach and relied more on lecturing when compared to graduate students who had only been instructors of record. This relation may be attributable to TAs working alongside instructors teaching large lecture courses, who may be less likely to utilize active-learning strategies. Note, however, that most of the graduate students with prior TA experience surveyed in Che et al. (2021) were in the field of psychology, which limits the generalizability of this finding to other disciplines. Nevertheless, other researchers have noted that faculty teaching lecture-based courses pass on attitudes about teaching to their TAs (Saitta et al., 2020). Gilmore et al. (2014) reported benefits of training TAs and providing teaching support in relation to their adopting a more student-focused approach. However, elsewhere in a nationally representative survey of engineering faculty, professional development had a larger effect in promoting learning-centered practices as compared to graduate training in teaching (Lattuca et al., 2014). This is in keeping with previous reports that graduate training for TAs often focuses on departmental procedures (e.g., grading policies) without requiring that TAs demonstrate evidence of competency in teaching (Luft et al., 2004; Brownell and Tanner, 2012). In the present study, we investigated further whether professional development and having prior experience in TA positions might have distinct relations to graduate students' teaching approaches and practices, while acknowledging that TA experience was mostly limited to psychology instructors.

1.3. Effects of personality on approaches to teaching

Over and above the influences of professional development and TA experience prior to becoming an instructor of record, graduate students' personality traits may be associated with how they approach teaching. To date, researchers have looked at Big Five personality traits (openness, conscientiousness, extraversion, agreeableness, and neuroticism) mostly in relation to measures of teaching effectiveness (see Kim et al., 2019, for meta-analytic review), with only a handful of studies focusing on instructors' personality traits in relation to teachers' behaviors and choices. In an early study linking personality traits to college teaching practices, Erdle et al. (1985) found the quality of being intellectually curious (i.e., openness to experience; Silvia and Christensen, 2020) was one of a set of traits associated with practices such as relating material to student interests and encouraging independent thinking, i.e., teaching behaviors that align with a student-focused approach (Davidson, 2017; Grose-Fifer et al., 2019).

Other researchers have similarly linked personality traits, and more specifically openness, with student-focused teaching. Reeve et al. (2018) examined Big Five traits of Korean elementary school teachers in relation to their adopting an autonomy-supportive motivational style, and found openness to experience, as well as agreeableness, to be associated with increased emphasis on developing student autonomy in the classroom. Zhang (2016) examined relations between the Big Five traits of college instructors in the People's Republic of China and their endorsements of ITTF and CCSF approaches to teaching (Trigwell and Prosser, 2004). Openness was positively associated with each of the two CCSF subscales (which represent having CCSF intentions and using CCSF strategies), and negatively associated with one of the two ITTF subscales (the subscale of ITTF referring to forming ITTF intentions). The other Big Five traits were less consistently associated with how the Chinese college instructors approached teaching; see also Zhang (2007) for results of a study involving high school teachers in the People's Republic of China using a different, but related scale. In sum, prior research on teachers' personalities suggests relations between Big Five traits and teaching approaches, especially with regard to aligning the trait of openness with student-focused teaching practices. In the present study, we aim to extend such findings to graduate students at the outset of their teaching careers.

1.4. Research aims and analytic plan

We conducted the present study to explore how graduate students employed as undergraduate instructors approach teaching, and whether variation in their practices is associated with professional development related to pedagogy, TA experience prior to being an instructor, and Big Five personality traits. Additionally, given that more than 50% of the graduate students in our sample were teachers of psychology, including the majority with TA experience (Che et al., 2021), we also examined whether academic discipline (psychology vs. other) was associated with variation in graduate students' teaching approaches and practices. The online survey included a diverse set of measures encompassing approaches to teaching, teaching strategies (i.e., lecturing, active

learning, provoking debate), teachers' self-reported awareness of their students' goals, valuation of student autonomy, and experiences of teaching autonomy, curricular emphasis on ethics and diversity and liberal arts skills, and use of practices related to backward course design.

As a preliminary step, we examined correlations among variables serving as indicators of graduate student characteristics: years of undergraduate teaching, engagement in professional development, TA experience prior to being an instructor of record, academic discipline, and Big Five personality traits. We predicted that Big Five traits might be related to (optional) participation in professional development, but not with paid employment as a TA prior to being an instructor of record. We had no other hypotheses for the preliminary analyses.

Next, we used correlational analysis to explore how graduate students' teaching practices fit within ITTF and CCSF approaches to teaching (Trigwell and Prosser, 2004). Previous analyses of the dataset (Che et al., 2021) indicated that graduate students' endorsements of an ITTF approach were associated with higher rates of lecturing, while endorsements of a CCSF approach were associated with greater use of active-learning strategies and higher self-reported awareness of students' goals. For the present set of analyses, we predicted that a CCSF approach would also align with provoking debate, positive attitudes toward student autonomy, emphasis on ethics/diversity issues, teaching liberal arts skills, and use of practices related to backward course design. With regard to graduate students' sense of autonomy in teaching, we predicted that instructors with more autonomy would use a broader range of student-focused practices (e.g., active-learning strategies, provoking debate, emphasis on ethics/diversity issues, teaching liberal arts skills, and use of practices related to backward course design) than those with less autonomy.

As a third step and final step, we applied hierarchical regression models to address the research question: Does participation in professional development, TA experience, being an instructor of psychology, and Big Five traits explain variation in graduate students' teaching practices? We hypothesized that participation in professional development related to pedagogy would promote use of active-learning strategies and other student-focused practices (Manduca et al., 2017; Reeve and Cheon, 2021). Based on the previous analyses linking TA experience with higher rates of lecturing and lower CCSF endorsements (Che et al., 2021), we expected graduate students with TA experience to endorse student-focused practices to lesser extent than their counterparts who had only been instructors of record. Thus, we predicted professional development related to pedagogy and TA experience to have opposing relations to how graduate students approached teaching. In line with prior research (e.g., Zhang, 2016), we also expected that the Big Five trait of openness would be negatively associated with an ITTF approach and lecturing, and positively associated with a CCSF approach and related practices (active learning, provoking debate, valuation of student autonomy, awareness of students' goals, emphasis on ethics and diversity, developing liberal arts skills, use of backward course design). We did not have specific hypotheses for other Big Five traits given limited and inconsistent findings in prior work (e.g., Zhang, 2007, 2016).

2. Methods

2.1. Participants

Graduate students employed as instructors of undergraduate courses at various universities were recruited to complete an online survey of teaching practices. Invitations were published in the Society for the Teaching of Psychology newsletter and distributed through email blasts to academic departments at the CUNY Graduate Center. To incentivize participation, graduate students were invited upon survey completion to enter a lottery to win one of 18 $50 gift cards. Data were collected from May to December 2018. The study was approved by the Institutional Review Board; participants gave informed consent when entering the survey.

A total of 135 graduate-student instructors opened the survey and answered at least the first research item. Twenty-six participants were dropped because they did not complete the Big Five Inventory and other scales. Based on demographic characteristics, the data appeared to be missing at random. The final analytic sample comprised 109 graduate-student instructors (69.7% women; M age = 30 years, SD = 6 years). Participants indicated that they had taught an average of 3.1 years (SD = 2.1; *Median* = 3.0 years; *Range* = 1 to 10 years). Most (94.5%) worked part-time as course instructors, while 5.5% had full-time teaching positions.

Participants reported their race/ethnicity, using non-mutually exclusive categories as follows: White (77.1%), Hispanic/Latino/a (12.8%), Asian (9.2%), African American/Black (3.7%), Native American (0.9%), and Other (1.8%). They reported having been in graduate school for an average of 4.2 years (SD = 2.0); 108 were enrolled in doctoral programs and one in a terminal master's program. Most (78.9%) had a master's degree; 17.4% had only a bachelor's degree, 1.8% had a previous doctorate, and 1.8% did not disclose. Over half (58.7%) were graduate students in psychology; the remainder were in humanities (20.2%; comparative literature, linguistics, philosophy), other social sciences (17.4%; anthropology, criminal justice, sociology), or STEM fields other than psychology (3.6%; environmental science, math, speech and hearing science). Including graduate students from multiple academic disciplines increased the statistical power of the analyses and enhanced the generalizability of the results. Given the composition of the sample, we recoded academic discipline as a binary variable where 1 = *psychology* and 0 = *other*. Most participants (74.3%) were employed as instructors at the City University of New York. The majority (90.8%) taught at public institutions. Most (68.8%) reported teaching classes with fewer than 50 students. Preliminary analyses indicated that psychology graduate students were more likely to teach larger sections ($\geq$ 50 students) than their peers teaching in other disciplines, 46.9% vs. 22.7%, X^2 (1, 109) = 11.81, $p < 0.001$. Course size was unrelated to years of teaching experience, $r(105) = 0.08$, $p = 0.399$. Only one instructor had taught a fully online course. No further details about courses were collected.

The data reported here were part of a larger study on graduate students' teaching practices. A previous report (Che et al., 2021) included findings for the Approaches to Teaching Inventory, active learning and lecturing teaching strategies, and the Teacher Awareness of Goals of Students scale. The other measures have not been reported elsewhere. Survey items, and all supplementary tables are uploaded as Supplementary material.

2.2. Measures

The online survey comprised multiple scales, each with multiple items. In cases where a participant skipped one or several items on a given scale, the missing values were imputed using item means. Percentages of data imputed for each measure are provided below. In all

cases, the percentage of missing data was low (≤5.5%) and appeared to be missing at random. Note also that in several instances, participants did not complete any items of a given scale and were dropped from analyses using that measure, as indicated below.

2.2.1. Big Five Inventory

We administered the 44-item Big Five Inventory as an assessment of personality traits: openness, conscientiousness, extraversion, agreeableness, and neuroticism (John and Srivastava, 1999). Participants responded to the prompt, "Please rate the extent to which you agree-or-disagree with each of the statements below. Offer your ratings with respect to how you are, in general, not specifically related to your teaching. I see myself as someone who…" using a 5-point Likert-scale ranging from 1 (*disagree strongly*) to 5 (*agree strongly*). Sample items included "Is curious about many different things" (openness), "Perseveres until the task is finished" (conscientiousness), "Has an assertive personality" (extraversion), "Has a forgiving nature" (agreeableness), and "Worries a lot" (neuroticism). All subscales had acceptable internal consistency: openness (10 items), $M = 3.91$, $SD = 0.62$, Cronbach's $\alpha = 0.82$; conscientiousness (nine items), $M = 4.00$, $SD = 0.68$, $\alpha = 0.87$; extraversion (eight items), $M = 3.23$, $SD = 0.93$, $\alpha = 0.91$; agreeableness (nine items) $M = 4.00$, $SD = 0.66$, $\alpha = 0.82$; neuroticism (eight items), $M = 2.97$, $SD = 0.93$, $\alpha = 0.90$. Supplementary Table 1 provides item-level descriptive statistics; 0.06% of the data were missing and imputed. Preliminary analyses indicated that graduate students in psychology scored lower on openness ($M = 3.76$, $SD = 0.61$, $n = 64$) as compared to graduate students in other disciplines ($M = 4.12$, $SD = 0.58$, $n = 45$), $t(107) = -3.10$, $p = 0.002$, $d = -0.60$, but did not differ with respect to the other Big Five traits, absolute values of all t's$(107) \leq 1.23$, $ps \geq 0.221$.

2.2.2. Professional development

We asked participants about their engagement in professional development using an item adapted from the Model Teaching Criteria (Boysen et al., 2015). This item was part of a larger block of Model Teaching Criteria items described below. Following the prompt "How well does each statement below describe you?" participants responded to the statement, "You participate in continuing education or professional development related to pedagogical strategies," using a 5-point Likert scale, ranging from 1 (*does not describe me well*) to 5 (*describes me extremely well*), $M = 2.72$, $SD = 1.50$, with 5.5% of the data missing and imputed. Graduate students in psychology did not differ from those in other disciplines in their self-reported engagement in professional development, $t(107) = 0.12$, $p = 0.906$.

2.2.3. Teaching assistant experience

Participants responded to the prompt, "What positions do you currently hold or have you held in the past?" by selecting from a list of titles including teaching assistant, adjunct faculty, substitute faculty, instructor/lecturer (a full-time position), and assistant professor. Over half 63.3% ($n = 69$) indicated having taught only as an instructor of record, while 36.7% ($n = 40$) indicated having worked as a TA in the past. This question was recoded as a binary variable where 0 = *taught only as an instructor of record* and 1 = *prior TA experience*. Of the graduate students with TA experience, most (80%, $n = 32$) were in psychology, with the others ($n = 8$) spanning six disciplines (anthropology, criminal justice, history, linguistics, mathematics, and philosophy). Half (50%) of the psychology instructors had prior TA experience in comparison to only 17.8% of instructors of other disciplines. Consequently, any conclusions drawn about TA experience may not generalize outside the field of psychology.

2.2.4. Approaches to Teaching Inventory

Participants completed a 16-item version of the Approaches to Teaching Inventory (Trigwell and Prosser, 2004), comprising an 8-item information transmission, teacher-focused (ITTF) scale and an 8-item conceptual change, student-focused (CCSF) scale. Participants indicated the extent to which they endorsed each statement using a 5-point Likert-scale ranging from 1 (*rarely true*) to 5 (*almost always true*). A sample item from the ITTF scale was, "I only provide the students with the information they will need to pass the exams or complete assignments." A sample item from the CCSF scale was, "I make available opportunities for students to discuss their changing understandings." Six participants did not complete the Approaches to Teaching Inventory and were dropped from analyses involving this measure. The two scales are independent measures; both had acceptable internal consistency: ITTF scale ($M = 3.09$; $SD = 0.67$, $\alpha = 0.69$, with 2.1% of the data imputed), CCSF scale ($M = 3.73$, $SD = 0.64$, $\alpha = 0.70$, with 0.6% of the data imputed). See Supplementary Table 2 for item-level descriptive statistics. Graduate students in psychology did not differ significantly from their peers in other disciplines on ITTF, $t(101) = 1.81$, $p = 0.074$, or CCSF scales, $t(101) = -1.47$, $p = 0.145$.

2.2.5. Instructional strategies

Participants responded to the prompt: "In a typical semester how often do you include each of the following teaching strategies in any of your classes?" using a 5-point Likert-scale ranging from 1 (*never*) to 5 (*in all classes*). One item assessed lecturing: $M = 4.30$, $SD = 0.84$; no data were missing. Six items assessed use of active-learning strategies (e.g., group work, role play, think-pair-share), $M = 2.86$, $SD = 0.74$, $\alpha = 0.75$, with 0.8% of the data imputed. See Supplementary Table 3 for item-level descriptive statistics. Graduate students in psychology reported lecturing ($M = 4.48$, $SD = 0.64$, $n = 64$) to a greater extent than their peers in other disciplines ($M = 4.04$, $SD = 1.02$, $n = 45$), $t(107) = 2.76$, $p = 0.007$, $d = 0.54$. Use of active learning strategies did not differ for graduate students in psychology vs. other disciplines, $t(107) = 0.28$, $p = 0.780$.

Five additional items assessed participants' attitudes about provoking debate in class. Four participants did not complete these items and were dropped from analyses using this scale. Participants were asked to indicate their agreement with statements that included, "It is important for students to express opinions that differ from those of their classmates and actively discuss those differences," and, "I intentionally use discomfort as a way to provoke students to reflect on their assumptions." They responded using a 5-point Likert-scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), $M = 3.66$, $SD = 0.76$, $\alpha = 0.75$, with 0.2% of the data imputed. See Supplementary Table 4 for item-level descriptive statistics. Psychology graduate students reported provoking debate ($M = 3.47$, $SD = 0.77$, $n = 61$) to a lesser extent than their peers in other disciplines ($M = 3.92$, $SD = 0.68$, $n = 44$), $t(103) = -3.07$, $p = 0.003$, $d = -0.61$.

2.2.6. Teacher Awareness of Goals of Students

Participants completed the Teacher Awareness of Goals of Students scale (Whiteman et al., 2017; Saltzman et al., 2018). Using a 5-point Likert-scale, ranging from 1 (*not true at all*) to 5 (*always true*), participants indicated their endorsements of six statements. Items included "I gather information from my students about what they hope to accomplish by taking my course." and, "I emphasize to students the

importance of setting realistic goals that they can achieve in taking my course." The scale had acceptable internal consistency, $M = 3.78$, $SD = 0.72$, $\alpha = 0.72$, with no missing data. See Supplementary Table 5 for item-level descriptive statistics. Graduate students in psychology did not differ from their peers in other disciplines in self-reported awareness of their students' goals, $t(107) = 0.88$, $p = 0.381$.

2.2.7. Autonomy in the classroom

Participants completed the Teaching Autonomy Scale (Pearson and Moomaw, 2006), an 18-item self-report measure of the extent to which teachers believe they have freedom to choose how they go about teaching. Participants responded to the prompt, "How much do you agree with each of the following statements," using a 5-point Likert-scale ranging from 1 (*disagree*) to 5 (*agree*). A sample item is "My teaching focuses on goals and objectives I select myself." Three participants did not complete this scale and were dropped from analyses involving the measure. The scale had acceptable internal consistency, $M = 4.04$, $SD = 0.76$, $\alpha = 0.93$; with 0.7% of the data imputed. See Supplementary Table 6 for item-level descriptive statistics. There were no significant differences between instructors of psychology and other disciplines on ratings of teaching autonomy, $t(104) = -0.99$. $p = 0.323$.

We also administered the Teacher Attitudes Toward Student Autonomy scale, a 14-item adaptation of the Teaching Autonomy Scale (Pearson and Moomaw, 2006) that assessed instructors' valuation and support of student autonomy in the classroom. Participants responded to the prompt, "Please rate how much you agree with each of the following statements. I encourage my students to…" using a 5-point Likert-scale ranging from 1 (*disagree*) to 5 (*agree*). A sample item is "develop their own guidelines and procedures (e.g., for writing papers)." (Note that the original 18-item Teaching Autonomy Scale included repetitive items; e.g., "In my teaching, I use my own guidelines and procedures" and "I follow my own guidelines on instruction." Such redundant items were excluded in the 14-item Teacher Attitudes Toward Student Autonomy scale.) Four participants did not complete the scale and were dropped from analyses involving the measure. The scale had acceptable internal consistency, $M = 2.76$, $SD = 0.77$, $\alpha = 0.89$, with 1.15% of the data imputed. See Supplementary Table 7 for item-level descriptive statistics. Graduate students in psychology ($M = 2.62$, $SD = 0.69$, $n = 62$) had more negative attitudes toward student autonomy in the classroom as compared to their peers in other disciplines ($M = 2.96$, $SD = 0.85$, $n = 44$), $t(104) = -2.27$, $p = 0.025$, $d = -0.45$.

2.2.8. Model Teaching Criteria

We administered four sets of items adapted from the Model Teaching Criteria (Boysen et al., 2015). Participants responded to the prompt, "How well does each statement below describe you?" using a 5-point Likert-Scale ranging from 1 (*does not describe me well*) to 5 (*describes me extremely well*); see Supplementary Table 8 for item-level descriptive statistics. Four participants did not complete any of the Model Teaching Criteria items and were dropped from corresponding analyses.

The first two sets of Model Teaching Criteria items were related to curricular emphasis on ethics/diversity and liberal arts skills. One additional participant did not complete any ethics/diversity or liberal arts skills items and was dropped from corresponding analyses. The ethics/diversity set comprised two "values" items from the content domain of the Model Teaching Criteria, "You infuse ethical issues throughout your teaching." and "You infuse diversity issues throughout your teaching.," $M = 3.99$, $SD = 1.03$, $\alpha = 0.81$, with no imputed data. The liberal arts skills set comprised five items from the content domain of the Model Teaching Criteria, e.g., "You foster the development of student written communication skills.," $M = 3.94$, $SD = 0.77$, $\alpha = 0.76$, with 0.2% of the data imputed. Graduate students in psychology did not differ from their peers in other disciplines with regard to teaching ethics/diversity, $t(102) = -1.79$, $p = 0.077$ or liberal arts skills, $t(102) = -1.70$, $p = 0.092$.

Two other sets of items within the Model Teaching Criteria related to backward course design (Wiggins and McTighe, 1998): organizing courses around learning objectives and making adjustments based on student progress and feedback. The learning objectives set comprised five items, four from the assessment process domain and one from the syllabus domain of the Model Teaching Criteria. An example item is, "You articulate specific, measurable learning objectives in your syllabi or other course documents." The set of items had acceptable internal consistency, $M = 4.33$, $SD = 0.60$, $\alpha = 0.76$, with 0.2% of the data imputed. The utilizing feedback set comprised six items, four from the assessment process domain and two from the student evaluations domain of the Model Teaching Criteria. An example item is, "You regularly monitor student learning in order to adjust your own teaching." Two additional participants skipped the utilizing feedback items and were dropped from analyses. The set of items had acceptable internal consistency, $M = 4.11$, $SD = 0.71$, $\alpha = 0.82$, with 0.3% of the data imputed. Graduate students in psychology did not differ from other graduate students in their use of learning objectives, $t(103) = 1.21$, $p = 0.229$, or in utilizing feedback, $t(101) = -0.08$, $p = 0.939$.

2.3. Procedure

The survey was hosted on Qualtrics, which provided an estimate of 40 min for completion. Measures were presented in the following order: Teacher Awareness of Goals of Students scale, Instructional Strategies (lecturing and active learning items intermixed), Big Five Inventory (openness, conscientiousness, extraversion, agreeableness, and neuroticism items intermixed), Teaching Autonomy Scale, Teacher Attitudes Toward Student Autonomy scale, Provoke Debate items, Model Teaching Criteria (professional development, ethics/diversity, liberal arts skills, learning objectives, and utilizing feedback items intermixed), and finally the Approaches to Teaching Inventory (CCSF and ITTF items intermixed).

3. Results

3.1. Correlational analyses

All analyses were conducted using IBM SPSS Statistics 27. As a preliminary step, we examined correlations between graduate student characteristics: years of teaching experience, participation in professional development, TA experience (0 = *taught only as instructor of record*, 1 = *prior TA experience*), academic discipline (0 = *other*, 1 = *psychology*), and Big 5 personality traits, see Table 1 for the correlation matrix (Note that all correlations were of the correct type, e.g., point-biserial correlations for a dichotomous variable correlated with a continuous variable.). As noted in the Introduction, we hypothesized that Big Five traits would be related to (optional) participation in professional development, but not with paid employment as a TA prior to being an

instructor of record. We had no further hypotheses for the preliminary analyses.

As shown in Table 1, after applying the Bonferroni correction for multiple tests ($\alpha = 0.0056$), participation in professional development was positively associated with years of undergraduate teaching experience, $r(107) = 0.32$, $p < 0.001$, and with the trait of openness, $r(107) = 0.27$, $p = 0.004$. Psychology as an academic discipline was positively associated with having TA experience, $r(107) = 0.33$, $p < 0.001$, and negatively associated with openness, $r(107) = 0.29$, $p = 0.002$. Additionally, openness correlated positively with agreeableness, $r(107) = 0.33$, $p < 0.001$, and neuroticism correlated negatively with conscientiousness, $r(107) = -0.43$, $p < 0.001$, extraversion, $r(107) = -0.36$, $p < 0.001$, and agreeableness, $r(107) = -0.46$, $p < 0.001$.

Next, we examined how specific teaching attitudes and practices aligned with graduate students' endorsements of ITTF and CCSF approaches to teaching; see Table 2 for the correlation matrix (Bonferroni adjusted $\alpha = 0.0042$). We expected that a CCSF approach would correlate positively with provoking debate, emphasis on student autonomy, ethics/diversity issues, liberal arts skills, and use of practices related to backward course design. (These correlations would be in addition to the positive correlations between a CCSF approach and use of active-learning strategies and self-reported awareness of students' goals, reported in Che et al., 2021).

As shown in Table 2, ITTF ratings correlated positively with lecturing, $r(101) = 0.41$, $p < 0.001$, and were negatively associated with valuation of student autonomy, $r(101) = -0.36$, $p < 0.001$. Lecturing correlated negatively with valuation of student autonomy in the classroom, $r(104) = -0.37$, $p < 0.001$, and with graduate students' own sense of autonomy in teaching, $r(104) = -0.29$, $p = 0.002$. CCSF ratings correlated positively with graduate students' use of active-learning strategies, tendency to provoke debate, self-reported awareness of students' goals, valuation of student autonomy, sense of autonomy in teaching, emphasis on ethics and diversity, and teaching liberal arts skills, all r's ≥ 0.32, $ps < 0.001$. Note also that the various indicators of student-focused teaching also tended to show positive correlations, with the strongest observed associations between graduate students infusing ethics and diversity into their teaching and teaching literal arts skills, $r(102) = 0.55$, $p < 0.001$, graduate students' intentions to provoke debate and their infusing ethics and diversity into their teaching, $r(102) = 0.48$, $p < 0.001$, and graduate students' self-reported awareness of student goals and teaching liberal arts skills, $r(102) = 0.44$, $p < 0.001$.

With specific regard to teaching autonomy, we expected that instructors with more autonomy would use a broader range of student-focused practices than those with less autonomy. As shown in Table 2, graduate students who reported having more autonomy in teaching were more likely to teach about ethics and diversity and foster development of liberal arts skills, r's ≥ 0.28, $ps < 0.003$.

With regard to graduate students' use of practices related to backward course design, neither learning objectives nor utilizing feedback were significantly associated with endorsements of ITTF or CCSF approaches. However, both of these practices correlated positively with graduate students' self-reported awareness of student goals and teaching liberal arts skills, r's ≥ 0.36, $ps < 0.001$, suggesting an alignment with a CCSF approach.

3.2. Hierarchical regression models

We then used hierarchical regression models to address our research question: Does participation in professional development, TA experience, being an instructor of psychology, and Big Five traits explain variation in graduate students' teaching practices? To ascertain whether our sample size of ~100 instructors was adequate for multiple regression analysis, we conducted post-hoc power analyses using G*Power 3.1. Across models, the estimated power for the full model approached 0.99, indicating that the sample size was adequate.

As an initial step in model building, we included years of undergraduate teaching experience and class size (0 = *<50 students*, 1 = *≥50 students*) as predictors of graduate students' teaching practices. Years of teaching experience was negatively associated with lecturing (i.e., novice instructors lectured more). Class size was positively associated with lecturing and negatively associated with provoking debate (i.e., more lecturing and less debate in classes with ≥50 students). However, these relations were no longer significant after controlling for professional development, TA experience, and academic discipline. Consequently, years of teaching experience and class size were not included in the final models.

In constructing the hierarchical regression models, we entered professional development, TA experience (0 = *taught only as instructor*

TABLE 1 Correlation coefficients between years of undergraduate teaching experience, self-reported engagement in continuing education/professional development, and Big Five personality traits (N =109).

	1	2	3	4	5	6	7	8	9
1. Years Teaching	–	0.32*	0.01	−0.25	0.09	0.06	0.18	−0.05	−0.02
2. PD Training	<0.001	–	−0.03	0.01	0.27*	0.02	0.22	0.19	−0.19
3. TA Experience	0.939	0.755	–	0.33*	−0.14	−0.05	0.08	−0.19	0.06
4. Psychology	0.009	0.906	<0.001	–	−0.29*	0.08	0.06	0.09	−0.12
5. Openness	0.330	0.004	0.151	0.002	–	−0.13	0.16	0.33*	−0.17
6. Conscientiousness	0.512	0.874	0.594	0.386	0.191	–	0.15	0.08	−0.43*
7. Extraversion	0.067	0.019	0.388	0.536	0.106	0.115	–	0.11	−0.36*
8. Agreeableness	0.576	0.044	0.045	0.365	<0.001	0.405	0.270	–	−0.46*
9. Neuroticism	0.869	0.051	0.556	0.221	0.08	<0.001	<0.001	0.001	–
−0.5 −0.4	−0.3	−0.2	−0.1	0	0.1	0.2	0.3	0.4	0.5

Cells below the diagonal presents unadjusted p-values with statistically significant Bonferroni corrected p-values highlighted in blue. Point bi-serial correlations were used for the dichotomous variables: TA experience (0 = no, 1 = yes), Psychology (0 = no, 1 = yes). Professional development training values for six participants were imputed. Shaded cells indicate the range of correlation coefficients between −0.5 (red) to 0.5 (green). *Statistically significant with Bonferroni corrected $\alpha = 0.0056$.

TABLE 2 Correlation coefficients between indicators of teaching approaches, attitudes, and practices.

	1	2	3	4	5	6	7	8	9	10	11	12
1. ITTF ($N = 103$)	–	−0.10	0.41*	−0.26	−0.23	0.10	−0.36*	0.21	−0.16	−0.05	0.15	0.03
2. CCSF ($N = 103$)	0.298	–	−0.22	0.35*	0.45*	0.35*	0.32*	0.33*	0.43*	0.51*	0.20	0.27
3. Lecturing ($N = 109$)	<0.001	0.025	–	−0.25	−0.22	−0.09	−0.37*	−0.29*	−0.16	−0.17	0.09	−0.01
4. Active Learning ($N = 109$)	0.009	<0.001	0.008	–	0.20	0.27	0.23	0.23	0.36*	0.34*	0.14	0.19
5. Provoke Debate ($N = 105$)	0.018	<0.001	0.024	0.040	–	0.16	0.33*	0.20	0.48*	0.30*	0.08	0.15
6. Awareness of Goals ($N = 109$)	0.336	<0.001	0.339	0.005	0.098	–	0.32*	0.19	0.21	0.44*	0.48*	0.38*
7. Student Autonomy ($N = 106$)	<0.001	<0.001	<0.001	0.019	<0.001	<0.001	–	0.26	0.32*	0.36*	0.08	0.29*
8. Teaching Autonomy ($N = 106$)	0.031	<0.001	0.002	0.018	0.042	0.049	0.007	–	0.33*	0.28*	0.17	0.23
9. Ethics/ Diversity ($N = 104$)	0.106	<0.001	0.097	<0.001	<0.001	0.029	0.001	<0.001	–	0.55*	0.26	0.31*
10. Liberal Arts Skills ($N = 104$)	0.631	<0.001	0.091	<0.001	0.002	<0.001	<0.001	0.003	<0.001	–	0.45*	0.36*
11. Learning Objectives ($N = 105$)	0.141	0.039	0.338	0.142	0.417	<0.001	0.423	0.079	0.008	<0.001	–	0.47*
12. Utilizing Feedback ($N = 103$)	0.769	0.006	0.924	0.058	0.123	<0.001	0.003	0.021	0.002	<0.001	<0.001	–
−0.6	−0.5	−0.4	−0.3	−0.2	−0.1	0	0.1	0.2	0.3	0.4	0.5	0.6

Cells below the diagonal presents unadjusted p-values with statistically significant Bonferroni corrected p-values highlighted in blue. ITTF = Information Transmission/Teacher-Focused scale; CCSF = Conceptual Change/Student-Focused scale; Student Autonomy = Teacher Attitudes Toward Student Autonomy scale; Awareness of Goals = Teacher Awareness of Goals of Students scale. Shaded cells indicate the range of correlation coefficients between −0.6 (red) to 0.6 (green). *Statistically significant with Bonferroni corrected $\alpha = 0.0042$.

of record, 1 = *prior TA experience*), and academic discipline (0 = *other*, 1 = *psychology*) as predictors of teaching practices in the first block (Model 1) and Big Five traits as additional predictors in a second block (Model 2). This allowed us to determine whether personality traits accounted for variance in graduate students' teaching practices over and above effects of other relevant factors. Collinearity diagnostics were acceptable across models (variance inflation factors ≤1.82; tolerance ≥0.55), and normality assumptions were met (Field, 2009).

Table 3 presents the regression models for information transmission, teacher-focused (ITTF) and conceptual change, student-focused (CCSF) approaches to teaching. ITTF endorsements decreased as a function of participation in professional development. ITTF endorsements were higher for graduate students in psychology as compared to other academic disciplines and were positively related to conscientiousness. CCSF endorsements, on the other hand, were lower for graduate students with TA experience (mostly psychology instructors), and were not related to Big Five traits.

Table 4 presents the regression models for teaching strategies (lecturing, active learning, provoke debate). Similar to the results for ITTF endorsements, use of lecturing as a teaching strategy decreased as a function of participation in professional development. Rates of lecturing were higher for graduate students with TA experience and psychology instructors, in general. Adding Big Five traits as predictors of lecturing did not improve model fit.

In contrast to its negative relation to lecturing, participation in professional development predicted increased use of active-learning strategies and willingness to provoke debate in class. However, both of these relations became non-significant after adding Big Five traits to the respective models. Graduate students who scored higher on

agreeableness were more likely to use active-learning strategies. Graduate students who were teaching psychology and those who scored higher on conscientiousness were less likely to provoke debate.

Table 5 presents the regression models for the Teacher Awareness of Goals of Students scale, Teacher Attitudes Toward Student Autonomy scale, and Teaching Autonomy Scale. Graduate students who scored higher on openness expressed higher awareness of their students' academic goals and had more positive attitudes about student autonomy. Valuation of student autonomy increased as a function of participation in professional development, while also showing a negative association with extraversion (i.e., a positive association with introversion). With regard to graduate students' perceived teaching autonomy, the only associated variable was TA experience, such that graduate students who previously held TA positions experienced less teaching autonomy than their peers who had only been instructors of record.

Table 6 presents the regression models for the four sets of teaching practices taken from the Model Teaching Criteria. Participation in professional development was associated with each set of practices; however, with the exception of utilizing feedback, these relations became non-significant when Big Five traits were included in the full models. Graduate students who scored higher on openness placed greater emphasis on teaching ethics/diversity and liberal arts skills. In addition to these relations, teaching ethics/diversity had a negative association with TA experience, and teaching liberal arts skills had a positive association with extraversion. Graduate students who scored higher on conscientiousness were more likely to utilize practices associated with backward course design: organizing courses around learning objectives and making adjustments in response to feedback. Big Five traits of agreeableness and neuroticism were also associated positively with graduate students' tendency to utilize feedback.

TABLE 3 Standardized regression coefficients for hierarchical regression models predicting approaches to teaching.

Predictor	Information Transmission/ Teacher-Focused scale (*N*=103)		Conceptual Change/Student-Focused scale (*N*=103)	
	Model 1	Model 2	Model 1	Model 2
Professional development	−0.31***	−0.33***	0.16	0.06
TA experience	−0.09	−0.09	−0.24*	−0.21*
Psychology discipline	0.20*	0.21*	−0.06	−0.06
Openness		0.10		0.12
Conscientiousness		0.30**		−0.09
Extraversion		0.09		0.08
Agreeableness		−0.17		0.19
Neuroticism		−0.08		−0.06
F	4.94**	4.31***	3.73*	2.73**
(df)	(3, 99)	(8, 94)	(3, 99)	(8, 94)
R^2	0.13	0.27	0.10	0.19
ΔF		3.55**		2.01
(df)		(5, 94)		(5, 94)
ΔR^2		0.14		0.09

*$p < 0.05$; **$p < 0.01$; ***$p < 0.001$.

4. Discussion

Many colleges and universities employ graduate students as undergraduate instructors, yet few researchers have examined whether variation in their teaching approaches, attitudes, and strategies is linked to their participation in professional development, TA experience, and academic discipline. Additionally, while research has linked instructors' personalities with their teaching and teaching behaviors (Zhang, 2016),

TABLE 4 Standardized regression coefficients for hierarchical regression models predicting teaching strategies.

Predictor	Lecturing (*N*=109)		Active Learning (*N*=109)		Provoke Debate (*N*=104)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Professional development	−0.28**	−0.24*	0.24**	0.16	0.20*	0.12
TA experience	0.20*	0.17	0.17	−0.12	−0.14	−0.14
Psychology discipline	0.20*	0.23*	0.08	0.11	−0.24*	−0.22*
Openness		0.03		0.20		0.10
Conscientiousness		0.08		−0.01		−0.23*
Extraversion		−0.07		0.00		0.13
Agreeableness		−0.12		0.27*		0.12
Neuroticism		0.06		0.14		−0.04
F	7.91***	3.39**	3.47*	3.21**	5.58***	3.71***
(df)	(3, 105)	(8, 100)	(3, 105)	(8, 100)	(3, 101)	(8, 96)
R^2		0.21	0.09	0.20	0.14	0.24
ΔF		0.74		2.86*		2.37*
(df)		(5, 100)		(5, 100)		(5, 96)
ΔR^2		0.03		0.11		0.09

*$p < 0.05$; **$p < 0.01$; ***$p \leq 0.001$.

TABLE 5 Standardized regression coefficients for hierarchical regression models predicting Teacher Awareness of Goals of Students, Teacher Attitudes Toward Student Autonomy, and Teaching Autonomy.

Predictor	Teacher Awareness of Goals of Students (*N*=109)		Teacher Attitudes Toward Student Autonomy (*N*=106)		Teaching Autonomy Scale (*N*=106)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Professional development	0.18	0.07	0.29**	0.26**	0.14	0.02
TA experience	−0.08	−0.03	−0.10	−0.09	−0.21*	−0.19
Psychology discipline	0.11	0.17	−0.19	−0.06	−0.02	0.01
Openness		0.33**		0.30**		0.20
Conscientiousness		0.13		−0.17		−0.02
Extraversion		0.01		−0.21*		0.16
Agreeableness		0.09		0.00		0.16
Neuroticism		−0.02		0.03		−0.00
F	1.73	2.78**	5.47**	5.06***	2.61	2.70**
(df)	(3, 105)	(8, 100)	(3, 102)	(8, 97)	(3, 102)	(8, 97)
R^2	0.05	0.18	0.14	0.29	0.07	0.18
ΔF		3.30**		4.29***		2.62
(df)		(5, 100)		(5, 97)		(5, 97)
ΔR^2		0.13		0.16		0.11

*$p < 0.05$; **$p \leq 0.01$; ***$p \leq 0.001$.

TABLE 6 Standardized regression coefficients for hierarchical regression models predicting Model Teaching Criteria.

Predictor	Ethics and Diversity (*N*=104)		Liberal Arts Skills (*N*=104)		Learning Objectives (*N*=105)		Utilizing Feedback (*N*= 103)	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Professional development	0.19*	−0.06	0.23*	0.06	0.24*	0.15	0.31**	0.27**
TA experience	−0.23*	−0.23*	−0.15	−0.12	−0.04	−0.00	−0.06	−0.01
Psychology discipline	−0.09	−0.04	−0.11	−0.05	0.13	0.15	0.02	0.04
Openness		0.23*		0.33**		0.20		0.15
Conscientiousness		−0.20		0.07		0.40***		0.40***
Extraversion		0.12		0.23*		0.13		0.03
Agreeableness		0.15		0.20		0.14		0.25*
Neuroticism		−0.03		0.11		0.18		0.34**
F	4.41**	4.30***	3.73*	5.40***	2.62	4.22***	3.58*	4.17***
(df)	(3, 100)	(8, 95)	(3, 100)	(8, 95)	(3, 101)	(8, 96)	(3, 99)	(8, 94)
R2	0.12	0.15	0.10	0.31	0.07	0.26	0.10	0.26
ΔF		3.86**		5.86***		4.88***		4.18**
(df)		(5, 95)		(5, 95)		(5, 96)		(5, 94)
ΔR2		0.15		0.21		0.19		0.16

*$p < 0.05$; **$p < 0.01$; ***$p \leq 0.001$.

such findings have not been extended to graduate students at the outset of their teaching careers.

4.1. What factors align with graduate student engagement in professional development?

As a first step in our exploration of graduate students' teaching practices, we examined relations between years of undergraduate teaching experience, participation in professional development related to pedagogy, TA experience, academic discipline (psychology vs. other) and Big Five personality traits. The personality trait of openness correlated positively with graduate students' participation in professional development, which is in keeping with its characterization as the dimension of personality associated with seeking, utilizing, and appreciating new information and innovation (DeYoung, 2015). Openness has been linked to actively seeking experience and being reflective about the ideas encountered (McCrae and Costa Jr, 1997)

–– attributes that would seem to be especially important for graduate students to possess as new instructors.

From these results, one might infer that heightened openness to experience might lead graduate students to seek out ways of improving their teaching. Alternatively, engagement in professional development might increase graduate students' openness, which would be in keeping with research suggesting that openness as a trait is malleable to experience. For example, in a study of older adults enrolled in a cognitive training program to improve their inductive reasoning and puzzle-solving skills, participants in the program showed increases in openness relative to a control group after 16 weeks of training (Jackson et al., 2012). Similarly, Mühlig-Versen et al. (2012) reported increased openness in adults following a training program that prepared them for challenging volunteer work, with larger gains in openness observed among adults who had an internal locus of control. These findings suggest that engagement in activities that require effortful cognitive investment may also increase one's openness to experience.

Other research findings suggest that openness to improve one's teaching may be fostered by a supportive department, with implications for graduate student training. Snook et al. (2019) interviewed both tenure-track and contingent (adjunct) faculty at a medical institution and used confirmatory factor analysis to identify relations between perceived appreciation for trying new teaching methods, perceived connectedness with colleagues, one's identity as an educator, and openness to improve. For contingent faculty, perceived connectedness with colleagues was associated with their identity as educators, which in turn predicted their openness to improve as teachers. In contrast, for tenure-track faculty, perceived appreciation for trying new teaching methods had a direct association with their openness to improve and an indirect association with openness to improve, mediated by their identity as an educator. Snook et al.'s (2019) findings suggest the need for research that explores how contextual factors, such as perceived support for adjunct faculty and a sense of community within graduate programs, interact with personality and individual-differences factors in ways that impact graduate students' interest in pedagogy and efforts to improve as teachers. If personality traits are malleable, as research suggests, graduate training programs may want to cultivate openness as a means of encouraging graduate students to reflect on their pedagogy and seek ways to improve their teaching through professional development.

When we examined years of undergraduate teaching, TA experience prior to being an instructor of record, and academic discipline in relation to participation in professional development related to pedagogy, the only significant correlation was between years of teaching and professional development. This finding suggests that as graduate students gain experience as teachers, they may be more likely to find opportunities and/or receive greater external support and compensation for engaging in professional development to improve their teaching. Motivation and/or interest in teaching may be a mediating variable between years teaching and participation in professional development. As suggested by a reviewer, "graduate students who are motivated to be better teachers do more teaching and take advantage of professional development." In contrast, TA experience prior to being an instructor of record and academic discipline (psychology vs. other) were not related to graduate students' investment in professional development related to pedagogy. A practical implication is that graduate programs may need to encourage and incentivize participation in professional development related to pedagogy, and in doing so communicate its value, if they want their TAs and novice instructors to adopt a student-focused approach. In future work, researchers might also re-examine differential support for different types of professional development activities in academic departments as a reflection of their priorities for graduate student training. For example, graduate students might receive financial support to attend research conferences where they hone their skills in public speaking (i.e., lecturing), but not for attending teaching conferences where they learn about evidence-based pedagogy. Further research is also needed to examine how TA experiences vary across academic disciplines, given that the majority (80%) of graduate students with TA experience in the present study were teachers of psychology.

4.2. Which teaching attitudes and practices align with teacher- and student-focused approaches?

Next, we examined the extent to which graduate students' varied teaching attitudes and practices aligned with information transmission, teacher-focused (ITTF) and conceptual change, student-focused (CCSF) approaches to teaching. Confirming and extending prior work (e.g., Prosser and Trigwell, 1999, 2014), the correlational analyses showed expected relations between ITTF ratings and reliance on lecturing and between CCSF ratings and use of active-learning strategies, intentions to provoke debate, teaching about ethics and diversity, and emphasis on liberal arts skills.

Higher endorsements of a CCSF approach were also associated with graduate students having greater self-reported awareness of their students' goals, more positive attitudes toward student autonomy, and an increased sense of teaching autonomy. Such findings are in keeping with Prosser and Trigwell (1999) who found that college instructors gave higher endorsements to a CCSF approach when they perceived having more autonomy and control over what was taught. Likewise, in a study of high school teachers (Könings et al., 2007), CCSF endorsements were predictive of higher ratings of perceived student autonomy in the classroom environment; however, the researchers did not measure valuation of student autonomy directly.

Reeve and Cheon (2021) suggested that autonomy-supportive teaching practices emerge from a student-focused attitude and a willingness to adopt students' perspectives during classroom instruction. Autonomy-supportive practices contrast with efforts to control students, behaviorally or psychologically. In the present study, graduate students' self-reported awareness of their students' goals correlated with higher valuation of student autonomy in the classroom. This finding seems to be keeping with Reeve and Cheon's (2021) proposal that perspective taking increases the likelihood that instructors will create learning conditions that support students' developing autonomy. Graduate students who had more positive attitudes toward student autonomy also relied less on lecturing and gave lower endorsements to an ITTF approach. With regard to their own sense of autonomy in teaching, graduate students who reported more autonomy relied less on lecturing and were more likely to emphasize ethics/diversity issues and foster development of liberal arts skills. These findings replicate and extend the prior literature linking teaching autonomy and support of student autonomy with student-focused pedagogy.

4.3. How do professional development, TA experience, and academic discipline influence teaching?

We used regression models to explore links between participation in professional development, TA experience, and academic discipline

(psychology vs. other) and graduate students' teaching approaches, attitudes, and practices. Self-reported participation in professional development was associated with lower endorsements of an ITTF approach and decreased reliance on lecturing. Participation in professional development was also associated with increased use of active-learning strategies, more positive attitudes toward student autonomy, and greater utilization of feedback. Additional positive benefits associated with professional development were increased awareness of students' goals, greater emphasis on ethical/diversity issues, efforts to promote development of liberal arts skills, and increased use of learning objectives; however, these effects became non-significant when personality traits were included in the full models. This set of findings aligns with research suggesting that professional development improves teaching of early career faculty, specifically in relation to promoting active learning and other student-focused practices (Gibbs and Coffey, 2004; Emery et al., 2020).

In contrast, TA experience appeared to influence graduate students' teaching in ways opposite to what was observed for pedagogy-related professional development. Compared to those who had only taught as instructors of record, graduate students with prior TA experience relied more on lecturing, gave lower ratings to a CCSF approach to teaching, and were less likely to infuse ethical/diversity issues into their teaching. These findings are rather concerning, given that 80% of the graduate students with TA experience in our sample were teachers of psychology and the APA Guidelines for the Undergraduate Major are explicit in listing "ethical and social responsibility in a diverse world" as a learning objective (American Psychological Association, 2013). Notably, psychology instructors did not differ overall in teaching ethics/diversity issues as compared to instructors of other disciplines. Rather this finding was specific to those with TA experience, who appeared more reticent in engaging students in difficult discussions than their counterparts without TA experience. Due to the limited number of non-psychology TAs in our sample, we grouped all other disciplines together in our analyses. However, given the likelihood that TA responsibilities differ considerably across academic disciplines (e.g., providing writing support in an English course vs. technical support in a STEM lab course), we emphasize that caution is warranted in generalizing the findings for TAs beyond the discipline of psychology. Despite the limitations of the present sample, our findings add weight to long-standing concerns about the pedagogical training provided to TAs at many universities (Luft et al., 2004), and resonate with observations that faculty members tend to impart teacher-focused practices to the TAs they supervise (Saitta et al., 2020).

The graduate students with TA experience prior to being an instructor of record reported less autonomy in teaching as compared to their peers who had only taught as instructors of record. This finding aligns with results from a small-scale study involving graduate students employed as TAs of undergraduate engineering courses, where the majority reported a lack of autonomy in making teaching decisions (Winters and Matusovich, 2011). In a study of graduate student TAs of an introductory science course, Dotger (2011) reported that conversations between TAs focused mostly on logistics and managing problems with students, rather than on student learning or pedagogy. Further, TAs described receiving limited input from faculty. In research with K–12 educators, teachers who felt more pressure from supervisors, such as having to comply with performance standards or use a set curriculum, reported lower autonomy and were more controlling of their students (Pelletier et al., 2002). Given the present finding that instructors with prior TA experience felt a lack of autonomy in teaching, a practical implication would be to find ways of promoting agency among graduate student TAs by involving them in course planning as "co-instructors" of undergraduate courses. Departments should make an effort to provide regular opportunities for faculty and TAs to engage in thoughtful discussions around pedagogy and provide training in evidence-based practices, active-learning strategies, backward course design, and the like.

Over and above the effects of professional development and TA experience, we observed associations between academic discipline (psychology vs. other) and graduate students' teaching attitudes and practices. Graduate students in psychology gave higher endorsements to an ITTF approach, lectured more, and were less likely to provoke debate than their peers in other disciplines (though instructors in general gave high endorsements to this scale). The extent to which graduate students are willing to provoke debate may be related to the topics covered in their courses (unfortunately, our survey did not include questions about specific courses taught). Psychology instructors may need to discuss a wide range of difficult topics (e.g., race, sexuality, religion, poverty, mental health), but may lack adequate preparation. One implication is that departments need to ensure that graduate students receive sufficient training in how to create "safe spaces" for discussing socially and politically charged issues, establish ground rules for respectful dialogue, and promote social justice in their courses (Case, 2017; Tatum, 2019).

In preliminary analyses, both lecturing and provoking debate were related to class size, such that teachers of larger classes tended to lecture more and were less likely to encourage debate. Given that graduate students in psychology reported teaching larger class sections than their counterparts in other disciplines, the findings for academic discipline may be attributable in part to the requirements of teaching large sections. However, ITTF endorsements were not related to class size, yet varied by academic discipline. Heightened emphasis on information transmission among the psychology graduate students might reflect the breadth of the psychology discipline and the broad content coverage in introductory and mid-level psychology textbooks (American Psychological Association, 2013; Richmond et al., 2021).

4.4. Are personality traits related to graduate students' teaching attitudes and practices?

After controlling for influences of professional development, TA experience, and academic discipline in the hierarchical regression models, we explored whether personality traits were related to graduate students' teaching practices. Following Zhang (2016), we hypothesized that openness would align with graduate students' endorsements of a CCSF approach and associated teaching attitudes and practices. Though we found openness to be associated with higher valuation of student autonomy, higher self-reported awareness of student goals, increased emphasis on liberal arts skills, and infusing ethics and diversity issues into teaching––all of which correlated with a CCSF approach––openness did not predict endorsements of the CCSF scale itself.

The personality trait of agreeableness correlated with openness, and was associated with use of active-learning strategies and with utilizing feedback. The association between agreeableness and active learning (a CCSF strategy) appears to contradict Zhang's (2016) findings linking agreeableness with use of ITTF strategies in a sample of academics from the People's Republic of China, suggesting that agreeableness may

have different relations to teaching practices in different cultures. Utilizing feedback was also weakly associated with CCSF ratings, $r(101) = 0.27$, $p = 0.006$, but not significant after Bonferroni correction. One might interpret its link with agreeableness as suggesting that utilization of feedback reflects a desire to please and be liked. This would fit with Kneipp et al.'s (2010) observation that college instructors' self-ratings of agreeableness predicted student evaluations of their teaching effectiveness.

Zhang (2016) did not find any relations between conscientiousness and college instructors' approaches to teaching. In contrast, we found conscientiousness to have a positive association with ITTF ratings and a negative association with provoking debate (a CCSF-aligned strategy). Conscientiousness was related to both teaching practices associated with backwards course design (Wiggins and McTighe, 1998), i.e., organizing courses around learning objectives and utilizing feedback. In interpreting this complex pattern of findings, it is helpful to recall that ITTF and CCSF are orthogonal dimensions of teaching, as opposed to opposite ends of a continuum (Trigwell and Prosser, 2004). That is, conscientious instructors may mix and match their approaches. Taken together, our findings suggest that conscientiousness may be predictive of a desire to be in control of the learning environment, which may include providing coverage of course material (i.e., information transmission), planning coursework around measurable outcomes, and monitoring student progress to ensure that the learning objectives are met. These behaviors fall within the six factors of conscientiousness identified by Roberts et al. (2005), including impulse control, conventionality, responsibility, industriousness, order, and virtue. In a study of elementary and secondary pre-service teachers, those who scored lower on conscientiousness and higher on openness were more likely to emphasize a relaxed approach to classroom management as opposed to a highly disciplined classroom setting (Decker and Rimm-Kaufman, 2008). Need for control may also encourage direct instruction (an ITTF approach) and discourage instructors from allowing students to debate controversial and sensitive topics––a situation that could result in unexpected and uncontrolled outcomes, such as student discomfort or intergroup conflict. Conscientiousness was negatively related to neuroticism, though both correlated positively with utilizing feedback. Utilizing feedback may emerge from a desire to be in control (conscientiousness) but may also relate separately to instructors' anxiety (neuroticism). Whereas Zhang (2016) found neuroticism to be associated with ITTF intentions, we found no evidence linking neuroticism with either CCSF or ITTF ratings.

Considered as a set of related findings, the discrepancies between Zhang's (2016) and our results may be attributed to differences in employment status (graduate students vs. faculty) or cultural context (American vs. Chinese universities) and warrant further study. To date, there has been very little cross-cultural research on personality in relation to teaching. Gao and Liu (2013) examined traits associated with effective teaching through an analysis of narratives of students in teacher education programs (i.e., preservice teachers) in the U.S. and the People's Republic of China. Whereas Chinese teachers-in-training emphasized the importance of *agreeableness*, *friendliness*, *patience*, and *caring*, their American counterparts placed greater emphasis on *responsibility*, *adaptability*, and *sense of humor*. Although Gao and Liu (2013) did not measure Big Five traits directly, the observed emphasis on agreeableness in the Chinese narratives, but not in the American narratives, suggests that this trait may relate differently to novice instructors' conceptualizations of effective teaching in China than it does in the US. Further crosslinguistic research is needed to elucidate the role of contextual expectations (e.g., of institution and country) in relation to personality and teaching approaches, attitudes, and practices.

4.5. Conclusion, limitations, and future directions

In the present study, we explored how professional development, TA experiences prior to being an instructor of record, academic discipline, and Big Five traits influence how graduate students approach teaching. We found self-reported participation in professional development and TA experiences to have opposite relations to graduate students' teaching practices. Self-reported participation in professional development had positive associations with openness and with multiple teaching practices aligned with a student-focused approach. TA experience prior to being an instructor of record, on the other hand, had a negative association with endorsements of a CCSF approach. Graduate students with prior TA experience (mostly psychology instructors) appeared to rely more on traditional, lecture-based teaching than their peers who had only taught as instructors of record. Instructors with TA experience expressed less autonomy in teaching and were less likely to teach about ethics and diversity than those who did not have TA experience. Of the Big Five traits, openness (and agreeableness to a lesser extent) aligned with student-focused teaching practices and values, while conscientiousness aligned with a teacher-focused approach and with practices aligned with control over student learning, including backwards course design.

One limitation is that we did not collect data regarding individual TA experiences such as their duration of training, work requirements, extent of faculty supervision and observation, and student evaluations. Further work is needed to determine which aspects of TA experiences have the most influence in shaping how graduate students approach teaching. Also, as noted previously, our sample of instructors skewed toward psychology; thus, the findings related to TA experience may not generalize across disciplines. Another limitation is that we did not collect information about the specific courses instructors taught, which may have influenced their choice of teaching methods. Graduate students may be endorsing lecturing for various reasons, including emphasis on broad content coverage in survey-level, introductory courses (Cuseo, 2007; Richmond et al., 2021) and/or lack of familiarity or confidence with student-focused pedagogy (Smollin and Arluke, 2014). Instructors may also feel that utilization of active-learning strategies increases the amount of time required for course preparation (Froyd et al., 2013), though the opposite may be true (Davidson and Katopodis, 2022).

Further work is needed on how social and cultural contexts influence graduate students' teaching approaches, attitudes, and practices. This would include studies of how the expectations and practices embedded in the climate of graduate training programs influence how graduate students go about teaching. Our findings suggest that the ideal departmental climate for supporting graduate students as new instructors is one that supports engagement in professional development to improve pedagogy, encourages openness to new experiences, fosters agreeableness in interacting with students, and promotes conscientiousness in relation to course planning around learning objectives and adjusting teaching in response to feedback. Graduate programs should also take a critical look at the way TAs are

used in their departments, and how they might cultivate interest in student-focused practices and promote agency among TAs by including them in course decision-making.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

The studies involving human participants were reviewed and approved by City University of New York (protocol 2016-0209-CSI). The patients/participants provided their written informed consent to participate in this study.

Author contributions

EC secured funding for the project, built the survey, analyzed the data, and co-wrote the manuscript. PB contributed to survey design and data analyses and wrote the first draft of the manuscript. AS, ES, and RW contributed to survey design, reviewed analyses, and edited the manuscript. All authors contributed to the article and approved the submitted version.

Funding

The research was supported by a Doctoral Student Research Grant awarded to EC from the CUNY Graduate Center.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2023.982998/full#supplementary-material

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