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Graduate Teaching Assistants (GTAs): Roles, Perspectives, and Prioritizing GTA Workforce Development Pathways

Claire L. McLeod [1,*], Catherine B. Almquist [2], Madeline P. Ess [1], Jing Zhang [3], Hannah Schultz [3], Thao Nguyen [3], Khue Tran [3] and Michael Hughes [3]

[1] Department of Geology and Environmental Earth Science, Miami University, Oxford, OH 45056, USA; essmp@miamioh.edu
[2] Department of Chemical, Paper and Biomedical Engineering, Miami University, Oxford, OH 45056, USA; almquic@miamioh.edu
[3] Department of Statistics, Miami University, Oxford, OH 45056, USA; zhangj8@miamioh.edu (J.Z.); schulth4@miamioh.edu (H.S.); nguye142@miamioh.edu (T.N.); trankt@miamioh.edu (K.T.); hughesmr@miamioh.edu (M.H.)
* Correspondence: mcleodcl@miamioh.edu

Abstract

Graduate Teaching Assistants (GTAs) play a pivotal role in supporting and advancing the educational mission of universities globally. They are fundamental to a university's instructional workforce and their roles are critical to the undergraduate student experience. This study examines the experiences and perceptions of GTAs (n = 74) at an R2 institution in the Midwest, U.S. Survey results reveal that the majority of surveyed GTAs have been at the institution for at least one year, teach in face-to-face formats with classes typically ranging from 12 to 30, and allocate 11–20 h/week to their instructional duties, although 30% of respondents report >20 h/week. Survey respondents reported a need for more teaching-focused onboarding, discipline-specific training, and more opportunities for feedback on their teaching practices, while almost 50% reported never engaging with discipline-based education research (DBER) literature. Although departmental and institutional training programs were acknowledged, so too was the perception of their lack of accessibility or relevance. Potential strategies for supporting GTAs, particularly early in their careers, include shadowing opportunities, sustained formal classroom management, and pedagogical training that includes an introduction to (and discussion of) the DBER literature, and a reduced teaching load in the first semester. Universities should prioritize and design GTA professional development using a cognitive apprenticeship framework. This would invest in the undergraduate student experience and directly support an institution's educational mission. It is also highly effective in preparing highly skilled graduates to enter an increasingly connected global workforce and could positively contribute to an engaged alumni base.

Keywords: graduate teaching assistants; workforce development; career-readiness

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1. Introduction

1.1. Graduate Student Teaching Assistants and Their Roles in Higher Education

Graduate student teaching assistants (GTAs) provide fundamental instructional support, often across multiple levels of undergraduate education (e.g., Park, 2004; Sargent et al., 2009; Weidert et al., 2012; Wan et al., 2020). With colleges and universities under increasing pressure to maximize budgets, increase undergraduate student enrollment, and increase the

instructional staff-to-student ratio, GTAs are serving in increasingly pivotal and essential roles, ones which directly support the missions of higher education institutions (e.g., Austin, 2002; DeChenne et al., 2012; Weidert et al., 2012; Kuh et al., 2015; Douglas et al., 2016; Wald & Harland, 2018). The U.S. Bureau of Labor Statistics (2023) provides a broad description of GTA roles, which includes assisting faculty or other instructional staff in postsecondary institutions by performing instructional support activities. However, assigned teaching responsibilities and expectations of GTAs vary widely between institutions, disciplines, and departments (Park & Ramos, 2002; Rao et al., 2021). Assigned duties may include teaching a course (either in person, hybrid, or online as the instructor of record), designing assessments, holding meeting hours, supporting faculty during classroom instruction, leading discussions, grading, providing feedback, and guest lecturing among other tasks (e.g., Weidert et al., 2012; Moon et al., 2013; Parker et al., 2015; Wald & Harland, 2018; Smallwood et al., 2022; Geragosian et al., 2024).

In the United States (U.S.), GTAs comprise a significant component of an institution's contingent, non-tenure track, instructional workforce with some institutions reporting that up to 26% of their undergraduate courses are taught by GTAs (e.g., U.S. News and World Report, 2017; Ahmed & Rosen, 2018; Donadel, 2023). Quantifying the number of graduate students in GTA roles in higher education across the U.S. for any given semester or academic year is, however, challenging as GTAs are assigned many teaching-related roles even when not assigned as the instructor of record. For example, the U.S. Bureau of Labor Statistics (2023) reported that 126,540 people were employed as postsecondary teaching assistants in the "Colleges, Universities, and Professional Schools" sector while according to Zippia (2025), there are >142,300 GTAs in the U.S. In addition, and from AAUP (2024) data, graduate students comprise 22% of the "academic workforce" in the U.S. at ~330,000 students. This is more than full-time tenured (18%), full-time tenure track (7%), full-time non-tenure track (10%) and full-time with no tenure system faculty (5%). Part-time faculty comprise the remaining 38%.

This increasing reliance on GTAs is occurring within an educational climate where the number of administrative and adjunct positions is rising and tenure track positions are decreasing (Schwartz et al., 2022). For example, in the decade between 2009 and 2019, the number of full-time, non-tenure track positions in the U.S. grew from 10% to 27% (data from 870 institutions that participated in the survey each year; Simonton, 2019). From analysis of data provided by the National Center for Education Statistics (NCES), the Integrated Postsecondary Education Data System (IPEDS), and the National Study of Postsecondary Faculty (NSOPF), the American Association of University Professors presented a summary of the U.S. academic workforce as of 2021 (see Figure 1a; AAUP, 2023). Over the time period reviewed (2002 to 2021), the number of graduate student employees in general (not solely GTAs) increased by 44% from 255,109 to 366,468. Over the same time period, the number of full-time and part-time faculty increased by only 19% (see Figure 1b).

1.2. The Value of GTA Positions

The national undergraduate education framework significantly relies on GTAs (Park & Ramos, 2002; Rao et al., 2021), with assigned teaching responsibilities and expectations varying widely between institutions, disciplines, and departments. Assigned duties may include teaching a course (either in person, hybrid, or online as the instructor of record), designing assessments, holding meeting hours, supporting faculty during classroom instruction, leading discussions, grading, providing feedback, and guest lecturing among other tasks (e.g., Weidert et al., 2012; Moon et al., 2013; Parker et al., 2015; Wald & Harland, 2018; Smallwood et al., 2022; Geragosian et al., 2024).

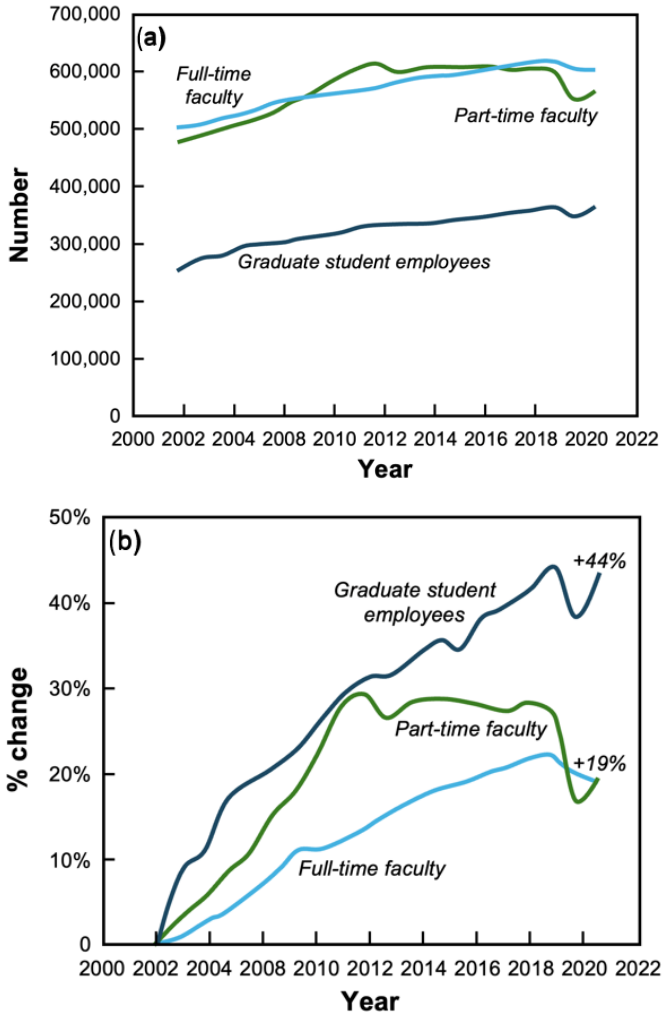

Figure 1. (**a**) Overall growth in the number of graduate student employees, part-time faculty, and full-time faculty from 2002 to 2021 in the U.S. (**b**) Percentage change in employment of graduate student employees, part-time faculty, and full-time faculty from 2002 to 2021 in the U.S. Modified from AAUP (2023).

Graduate students may accept a GTA position for many reasons. For some GTAs, the opportunity to contribute to the educational ecosystem of an institution is one of the early steps in their pursuit of a career in higher education (Glorieux et al., 2024). For others, the role aligns with intrinsic motivation, interest, and passion for teaching (Hoessler & Godden, 2015) while for others, they may be extrinsically motivated to accept a (paid) GTA position as it facilitates a pathway to graduate-level education and enables research (e.g., Nasser-Abu Alhija & Fresko, 2019; König, 2020; Clark et al., 2021). The assigned duties of a GTA also have the potential to serve (in part) as a crucial component of essential research-related skill building and can further support graduate students as they develop greater expertise in the disciplines in which they teach. As reported in French and Russel (2002), GTAs acknowledge their improved ability to conduct research, communicate methods and ideas, and transition from being a student to being a researcher. A decade later, Feldon et al. (2011) reported similar findings where graduate students who were assigned teaching-related responsibilities and conducted research, improved their abilities to develop a testable hypothesis and design appropriate experiments when compared to graduate students who were not assigned teaching responsibilities. Furthermore, a teaching role has the potential to positively contribute towards a GTAs academic experience, professional

identity development, employability, and market value (Bieber & Worley, 2006; Emmioğlu et al., 2017; Jordan & Howe, 2017; Mantai, 2019; Kilpatrick, 2021; Rao et al., 2021).

In addition to their roles and responsibilities as students and educators, GTAs also serve as (near) peer mentors, role models, and advisors, and can thus significantly contribute to the retention and persistence of an institution's undergraduate student population (e.g., Jackson, 2013; Anderson et al., 2018; Reeves et al., 2022; Goodwin et al., 2023; Ravishankar et al., 2024; Sadera et al., 2024). This is particularly true for students who identify with one or more historically minoritized populations (e.g., racial and ethnic minorities, women, and members of LGBTQ+ communities; Gardner & Jones, 2011; Rainey et al., 2018; Seyranian et al., 2018). For example, undergraduate students who racially identify with their GTAs are more likely to attend discussion sections and office hours and have a higher probability of enrolling in another course following completion of a course with a similarly raced GTA (see example from economics; Lusher et al., 2018). Within these contexts, GTAs occupy a liminal space with plural identities (e.g., Winstone & Moore, 2016; Mantai, 2019; Rao et al., 2021).

1.3. Challenges to GTA Professional Development and Success

GTAs often encounter challenges and sources of distress within their positions (Grady et al., 2014; Meanwell & Kleiner, 2014; Keefer, 2015) due to their workload burdens and the increasing undergraduate student enrollment and expectations (Park & Ramos, 2002). Many GTAs are often found trying to navigate the hidden aspects of curricula, which are implicit, unspoken, and unwritten, and therefore, not transparent (e.g., Portelli, 1993; Margolis, 2001; Hatt et al., 2009; Semper & Blasco, 2018; Calarco, 2020; Elliot et al., 2021; Lyles et al., 2022; Hopkins et al., 2024). Within the context of teaching, the lack of training, and large workloads can be detrimental to the GTAs experience (e.g., Gardner & Jones, 2011; Luft et al., 2004; Bettinger et al., 2016; Parker et al., 2015; Becker et al., 2017; Shum et al., 2020; Peng et al., 2024). Furthermore, GTAs may also encounter conflict with respect to the time they dedicate to their development as an educator. For example, there is the perception that teaching is "secondary" (Parker et al., 2015) to research (e.g., Ethington & Pisani, 1993; Torvi, 1994; Beath et al., 2012; Brownell & Tanner, 2012; Corrales & Komperda, 2018; Zotos et al., 2020; J. E. Sutherland et al., 2022). However, there is documented evidence that shows teacher training for GTAs neither negatively impacts the number of publications authored by GTAs nor compromises their degree completion (e.g., Connolly et al., 2018; Shortlidge & Eddy, 2018). Rather, GTAs who engage in teacher training will contribute to the national call for a "paradigm shift" (Shortlidge & Eddy, 2018) where faculty lead impactful research programs while also pursuing excellence in undergraduate education (Gilmore et al., 2014; Kajfez & Matusovich, 2017; Sadera et al., 2024).

1.4. Purpose and Scope of Study

As higher education institutions continue to rely on support from GTAs for the instruction of undergraduate courses (e.g., Ahmed & Rosen, 2018), it is imperative that GTAs are provided with sufficient training and support to not only facilitate their development as effective educators but also to enhance the undergraduate mission of higher education institutions. Therefore, this study sought to investigate the perceptions and experiences of GTAs as they pertain to their workloads and professional development. Data for this study was collected using a mixed-methods survey that yielded responses from GTAs predominantly in science, technology, engineering, and mathematics (STEM) fields (80% of respondents).

The survey was conducted at a rurally located R2 (Carnegie Classification) institution in the U.S. For context, R2 institutions are classified as "Doctoral Universities: high research

activity" and spend at least $5 million (USD) on research efforts annually. As an R2 institution, the teacher-scholar model (e.g., Chall, 1986; Boyer, 1990; Seron, 2002) is embedded throughout undergraduate and graduate curricula. As a result, the institution's mission is teaching-centered and emphasizes the role of research-informed pedagogy by encouraging faculty to be actively engaged in the scholarship of teaching and learning (SoTL). However, there is currently no institutional-level formalized training for GTAs with instructional preparation largely dependent on departments and programs (and individuals within the institution). This study was therefore guided by the following research questions:

1. What is the nature of the GTA workload at an R2 institution as it pertains to class type, class size, and course responsibilities?
2. Is there a correlation between GTA tenure and perception of value?
3. What training programs and opportunities exist at departmental and institutional levels to support GTA professional development?
4. What do GTAs at an R2 institution recommend as beneficial and impactful training in support of teaching?

2. Materials and Methods

2.1. Data Collection Survey

A mixed-methods survey was developed by a Faculty Learning Community (FLC), which met during AY 2023–24 to capture the perceptions of GTAs with respect to their teaching workloads and related training programs and opportunities. The survey titled "Strategies to Support Professional Development and Enhance Teaching Effectiveness" was distributed to all graduate students across all colleges, via the Graduate School Dean's office. The survey was distributed to the GTAs through multiple platforms (e.g., email, learning management system). The survey was issued during the early part of the 2024 spring semester via Qualtrics, was open over a 6-week period, and received 74 responses. From 2024 data, 389 graduate students held an instructional position at the university. Responses from GTAs were voluntary and non-incentivized. The survey questions are summarized in Appendix A. This included 9 multiple-choice questions, 2 seven-point Likert scale questions, 1 numerical open-ended response, and 4 open-ended text responses. This study received Institutional Review Board approval, protocol #04720e.

2.2. Statistical Tools and Methods

Statistical analysis software (R version 4.4.0 (R Core Team, 2021)) was used for analysis and data processing. Analysis included a summary of descriptive statistics, chi square tests of homogeneity to determine differences in response distributions, and logistic regression to assess relationships between two or more different responses. Coded variables are provided in Appendix A. Data cleaning was conducted as needed. For example, for the survey item that captured the respondent's number of years at the institution, some respondents provided text instead of a number, e.g., "6 months" or "Less than a year". These responses were manually converted to numbers or given an estimate based on appropriate rationales. Due to the feasibility issue of analyzing ordinal data with relatively high number of levels while having limited sample size, answer choices for certain Likert scale questions were condensed into fewer options in later data cleaning stages. Ultimately, the questions this approach refers to include whether a respondent agreed or disagreed with a survey item (see Qs 9 and 10, Table A1) and whether they perceived that the frequency of sharing course materials was frequent or infrequent (Q11, Table A1). Survey respondents were allowed to choose more than one answer for Qs.4, 6, 8 (Table A1). Selected choices were given a value of 1 and those not selected were given a value of 0. The 4 open-ended questions (Qs 13–16, Table A1) yielded qualitative data, which was analyzed to identify

common themes. Survey responses were analyzed by Claude.ai (v. 3.5 Sonnet; Anthropic, 2025) and ChatGPT (v. 4o mini; OpenAI, 2025), both of which are large language models (LLMs). The LLMs were provided with each survey question and prompted to "summarize the following survey responses". Following analysis by both LLMs, the authors reviewed the LLM outputs for themes and accuracy alongside the raw input data for each question. Combined with quantitative analysis, emergent themes from the qualitative analyses were used to better understand GTAs perceptions and to frame the recommendations presented in the discussion.

3. Results

3.1. Survey Respondents

Of the survey respondents, 80% were from the College of Arts and Science, 11% from the College of Engineering and Computing, 3% each from the College of Creative Arts, the Farmer School of Business, and the College of Education, Health and Society, and one respondent preferred not to disclose. A total of 80% of the respondents also teach primarily in STEM fields. The survey received 74 responses from 389 full-time instructional teaching assistants (a 19% response rate). Figure 2 summarizes the total number of years respondents have been at the institution (survey Q3). 16% (n = 12) of survey respondents reported being at the institution for less than a year and reflect graduate students who began their programs at the start of the 23–24 academic year (fall 2023). Almost half of the survey respondents (46%; n = 34) selected "1–2 years" and approximately a third (36%; n = 27) reported being at the institution for 3 to 6 years. Only one respondent reported >7 years.

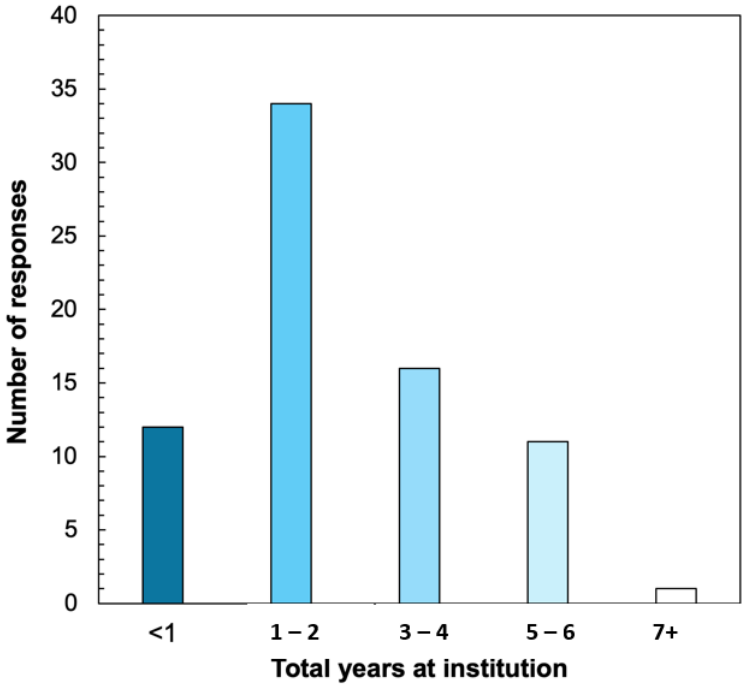

Figure 2. Summary of survey respondents' tenure at the institution.

The modality of courses that are taught by survey respondents are overwhelmingly face-to-face (91%). All other course modalities, including online and hybrid courses, were rarely taught by survey respondents (all $\leq$ 5%). The majority of respondents teach either 1–2 (69%) or 3–4 (27%) courses in an academic year, with approximately two thirds of respondents (67%) indicating that class sizes typically range from 12 to 30 students (Figure 3).

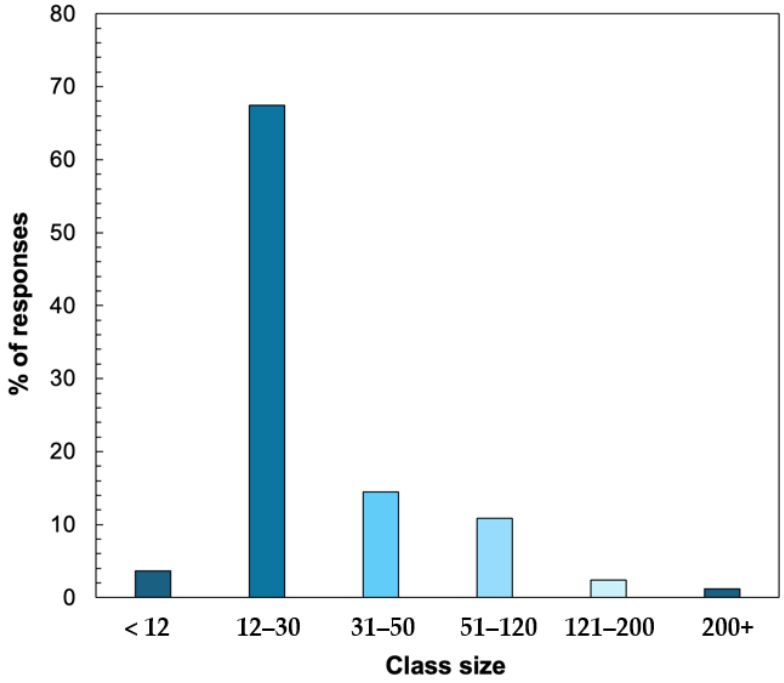

Figure 3. Summary of survey respondents' class sizes.

The estimated time typically spent typically on teaching-related duties per week varied, with 41% (n = 29) of respondents reporting between 11 and 20 h, 25% reporting 5–10 h, 25% reporting 21–30 h, and 2 respondents (<4%) each selecting <5 h, 31–40, or 41–50 h. Since GTAs are also expected to complete a research project as part of their graduate degree, GTAs should spend no more than 20 h/week on teaching-related activities per their assistantship guidelines. However, 30% of respondents reported spending >20 h.

The type of course that GTAs teach varies widely from introductory classes and labs to upper-level courses. Only one respondent reported teaching a graduate-level course (Figure 4).

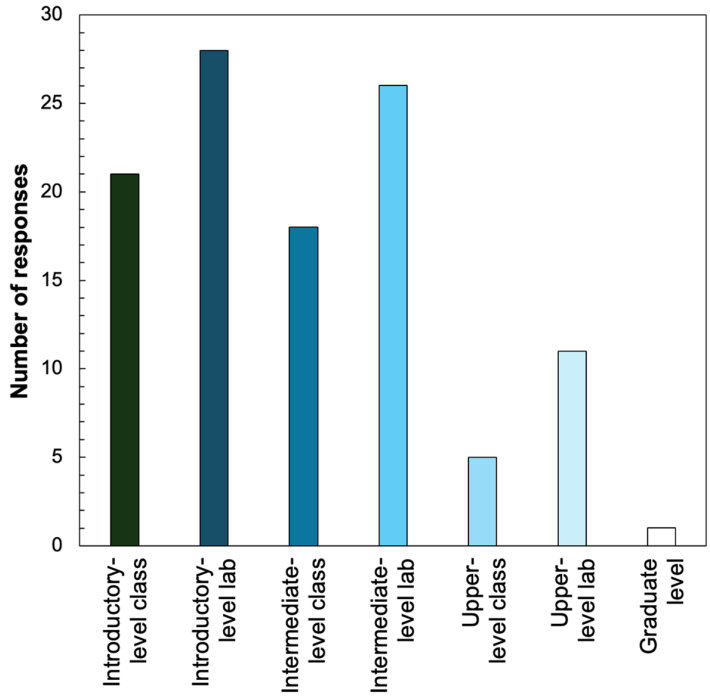

Figure 4. Summary of course type taught by GTAs (more than one response was permitted).

Across all course types, 40% of survey responses are associated with introductory-level courses, 36% with intermediate-level courses, and only 13% with upper-level courses. Of all the responses, 54% are associated with lab-based courses. In a typical academic year, 53% of survey respondents indicated they teach only one type of course and of those responses, 58% of those are at the introductory level (either class or a lab). Of the 45% who indicated they teach more than one type of course in an academic year, 78% include at least one introductory-level course or lab and 60% include at least one intermediate-level course or lab.

3.2. GTAs Perception of Value

Figure 5a,b shows the respondents' perception of how their efforts toward teaching are valued by students and by their department, respectively (Qs. 9 and 10, Table 1). Overall, GTAs perceive their teaching efforts to be valued by both the students they teach (93%; slightly agree to strongly agree) and the faculty in their departments (96%). Only (n = 5) of responses were negative with respect to feeling valued by the students they teach, and only 4% (n = 3) of responses were negative with respect to feeling valued by their departments and 6%.

A logistic regression model was used to investigate whether a relationship exists between a GTAs duration at the university and whether they perceive their teaching efforts to be valued. It was found that a GTAs duration at the institution does not have a statistically significant relationship with whether they feel valued by their department (p-value = 0.054, standard error = 0.311). This test does not meet the threshold for significance to be established (p-value < 0.05). Duration at the institution also does not have a significant relationship with whether a GTA feels valued by their students (p-value = 0.069, standard error = 0.267).

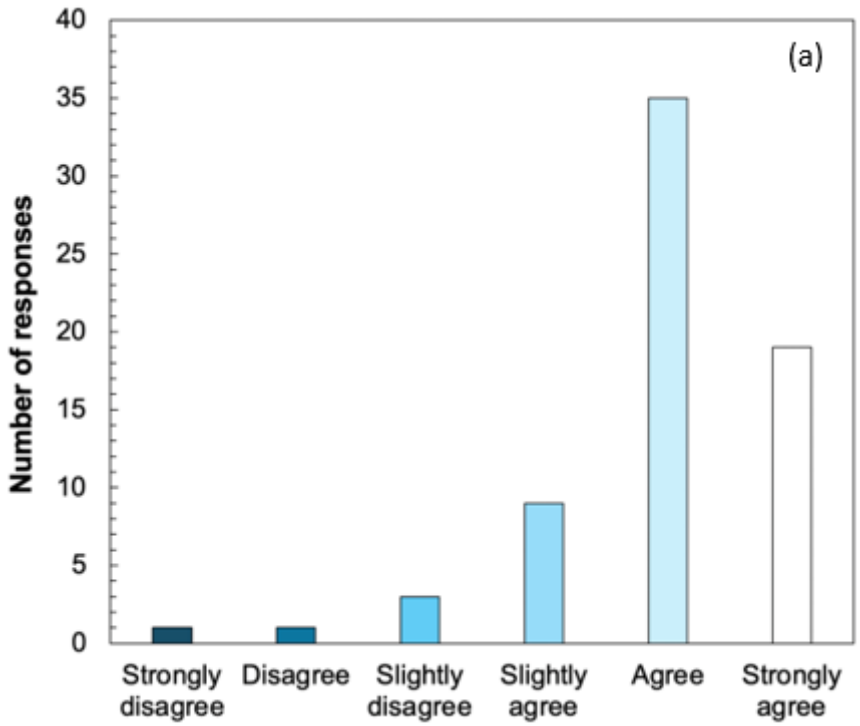

Figure 5. *Cont.*

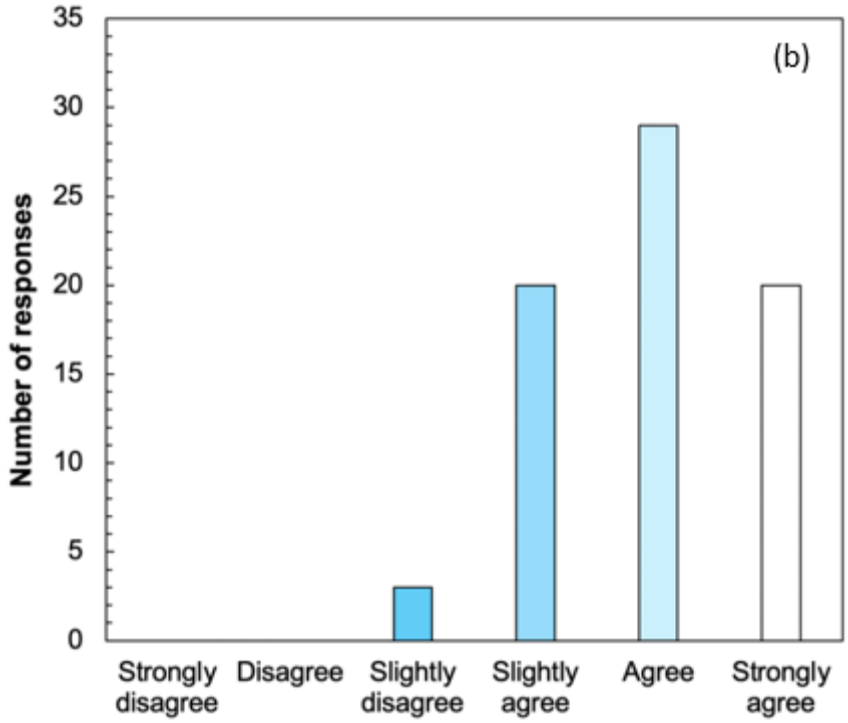

Figure 5. The extent to which GTAs agree or disagree that their teaching efforts are recognized and valued (**a**) by their students, and (**b**) by their departments.

3.3. Teaching-Related Support for GTAs

The support that GTAs receive at the institution within the context of teaching may come in many forms, including department mentoring, sharing of course materials, divisional communities and university programs. A total of 75% of respondents indicated that materials are shared, with only 6% indicating that materials are not shared. Two respondents provided comments in "other". Materials were provided to GTAs by their faculty or departments, depending on the course(s), through shared access to course-specific sites on a Learning Management System (LMS). In cases where there is no shared LMS site, faculty readily share materials with GTAs when asked. Regarding the extent to which GTAs consult the peer-reviewed literature associated with DBER, almost half of survey respondents replied "never", 27% replied "seldom (at least once a semester), with only 12% of respondents indicating that they often, or very often, consult the DBER literature.

Figure 6 presents the hours GTAs spend on teaching as a function of their duration at the institution. The majority of GTAs in their first year spend 11–20 h/week on teaching-related duties. GTAs who report >20 h per week spent on teaching duties have been at the institution 1 to 3 years, or ≥4 years. GTAs reporting spending 0–10 h/week exhibit the lowest range of total years at the institution across a relatively uniform distribution. Overall, it could be postulated that GTAs who remain at the institution for longer will spend more time on teaching tasks.

Survey questions 13–16 were open-ended (see Appendix A). Survey respondents were asked "What departmental informal or formal initiatives/programs exist to promote teaching effectiveness? (e.g., peer mentoring, DBER seminars)". This question received 45 responses, of which 10 replied "none, unknown, ?, or unsure". A total of 39% (n = 29) of survey respondents left a blank response. Respondents indicated that a variety of mentoring approaches exist. Examples include "Peer mentoring for incoming graduate students", whereby experienced graduate students informally mentor first-year graduate students, and course instructor-led mentoring with a focus on teaching best practices (e.g., course design, grading). While informal mentoring practices were among the most frequent

responses, several examples of formal training programs were provided, including "[a] Graduate Onboarding class [that] discusses teaching", 1-credit hour courses with a focus on teaching, teaching practicums, GTA training, and seminars with a pedagogical focus (at the department level). These opportunities are complemented by "weekly TA meetings" to support new GTAs transition into their GTA roles, share updates, review course structure and management, in addition to "Review meetings with all department GAs every week". Finally, several respondents shared their experience with "peer and teacher observations" as an approach to supporting teaching effectiveness at the department level. This included observations by both a peer and a faculty member, which included a review of teaching practices and a debrief centered on providing constructive feedback for improvement. While this survey question asked respondents to specifically consider department-level initiatives, several GTAs reported their awareness of, and involvement in, formal programs elsewhere on campus including the Center for Teaching Excellence, the Writing Center, and the College Teaching Certificate program: "webinars and workshops on specific aspects of teaching." Within the context of the above, several respondents also indicated time management challenges associated with their teaching and research responsibilities and their ability (or not) to fully engage with some of the reported initiatives. For example, one respondent reported that "with the amount of time that is already put toward teaching it can be difficult to prioritize outside teaching programs on top of research and classes."

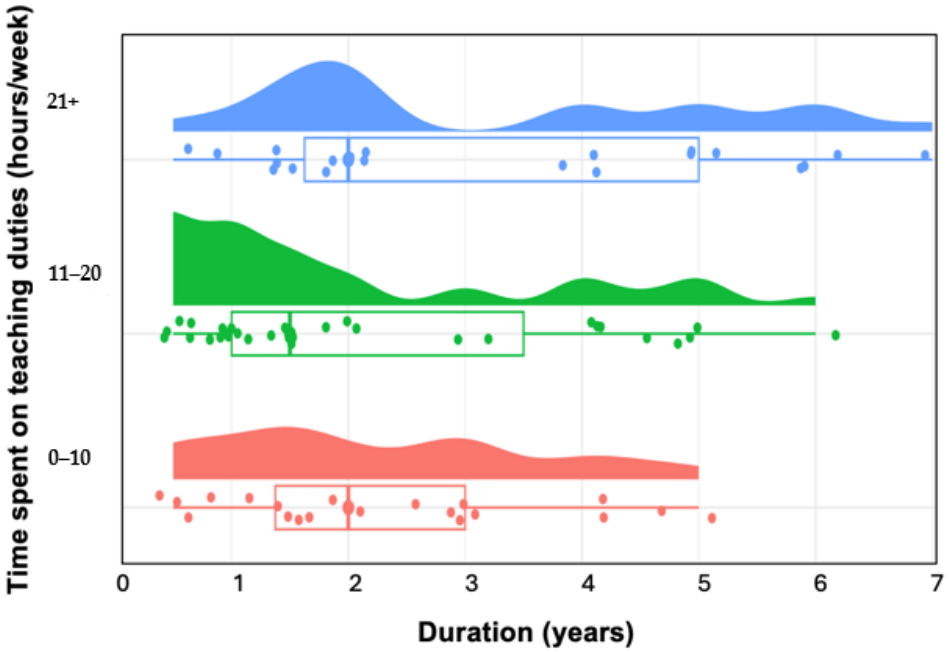

Figure 6. Summary of the relationships between GTA time at the institution and the time spent on teaching duties per week.

Survey respondents were asked "What divisional and institutional informal or formal initiatives/programs exist to promote teaching effectiveness?". This question received 36 responses, of which 14 replied "none, unknown, ?, or unsure". Other respondents indicated their awareness of the institution's formal College Teaching Certificate program which includes a series of courses designed to provide all graduate students with an opportunity to enhance their pedagogical knowledge and skills through interdisciplinary discussions and coursework: "I know there is the certificate for teaching that grad students can get"; "The Certificate of College Teaching is also at the institutional level, I believe". In addition, respondents were aware of "Different programs or workshops from the HWCE [Howe Center for Writing Excellence] and the CTE [Center for Teaching Excellence]", as

well as other teacher development workshops offered throughout the institution. However, respondents were uncertain if these opportunities were relevant and/or tailored to GTAs, and/or whether their participation was permitted. Survey respondents stated that "There are workshops at the center for teaching excellence but they don't seem to be geared for graduate students" and the programs are "not geared towards TA positions" but rather are "intended for those going into academia." One survey respondent shared that faculty demonstrations are a resource while one other reported the annual "Lilly Conference" on College Teaching, which the institution hosts, as an example of an opportunity that promotes teaching effectiveness. Examples of informal initiatives included self-motivated review of "canvas videos, trusted blogs and websites" (e.g., on X and other social media platforms) in addition to mechanisms reported in Q14 (e.g., peer-to-peer learning, feedback from their departments). Given that 39% of respondents replied "none, unknown, ?, or unsure", and that 51% (n = 38) of survey respondents left their response blank, there is an opportunity to increase the visibility of teaching effectiveness training programs across divisions and throughout the institution, in addition to clearly communicating how these are tailored to GTA professional development.

Survey respondents were asked "Do you have any ideas for initiatives/programs at [this university] you would like to see in support of teaching effectiveness? This question received 30 responses, of which 3 replied "no, not sure", 3 replied "N/A", and 2 replied "yes" without providing an additional response. A total of 59% (n = 44) of survey respondents left a blank response. From the responses received, perceptions are that current GTA training is insufficient and offered too broadly. There is a need for "more departmental initiatives/programs for teaching effectiveness" and an interest in a greater emphasis being placed on the connections between pedagogical theory and practice, in particular more hands-on training to go beyond theoretical guidance: "as of now, there is just pedagogy for 3 days that other grad students teach." In addition, communication of available resources needs to be improved and more opportunities to collaborate, receive feedback and coaching were requested. Specific ideas included "a more concrete orientation for graduate students (e.g., federal attendance requirement, building Canvas, how to add/drop students, how to put in midterm or final grades, etc.)" with one respondent stating "something like this would have been beneficial for my first semester teaching here, I was often told that it would just begin to feel natural and I "will get the hang of it". One respondent also stated "any programs would have been helpful." To support GTA onboarding, several respondents suggested a reduced course load at the start of their graduate program to allow time for teaching-centered training, including courses on pedagogy (beyond the 1–3 day orientation programs that are currently offered in some departments): "New graduate student training (reduce course load, do a semester of teacher training)." Some respondents also requested more workshops and seminars particularly with an emphasis on teaching STEM, writing, and/or reducing math anxiety: "Teach writing in STEM. Teaching how to overcome fear of math/numerical analysis/computers." One respondent suggested these seminars focus more on the role that GTAs have in their courses rather than curriculum development and course learning objectives.

Other specific ideas were associated with initiatives during a semester and included a pre-semester meeting with continued meetings throughout the semester to facilitate communication and collaboration between GTAs and professors, more opportunities to receive formative and summative feedback on teaching effectiveness in a timely manner (including peer reviews and evaluations from faculty), as well as opportunities for GTAs to evaluate their faculty mentors/supervisors: "More teaching evaluation from administration to help coach/improve teaching pedagogy." In addition, one respondent suggested a structured process through which GTAs could provide constructive feedback to faculty

on the teaching methods being used and one respondent suggested that GTAs should be offered more input regarding courses to which they are assigned: "Allowing GAs to have more input in which class they are assigned to." Finally, several respondents suggested monetary incentives be offered to GTAs to participate in teaching-related professional development, that career development funds to attend teaching-related workshops and conferences be offered, that these efforts be formally recognized, and that GTAs have the opportunity to be further recognized for their contributions via teaching awards: "I think it would be good if there were more incentives for participating in teaching effectiveness initiatives/programs at Miami–ideally monetary (especially for us graduate students)"; "I think it would be nice to have more workshops and career development funds for people wanting to go to workshops or conferences."

Survey respondents were asked "What teaching support would be helpful? (e.g., software, equipment?". This question received 33 responses, of which 3 replied "none, not sure", 2 replied "N/A", and 1 replied "yes" without providing an additional response. A total of 55% (n = 41) of survey respondents left a blank response. From the responses received, a variety of GTA needs were identified and included improved access to (and training on) technology that could be integrated into courses, including existing software (e.g., TopHat) and the LMS: "More training on canvas and other software related to teaching"; "More workshops on teaching software like TopHat and Canvas functionality hosted by CTE or departmental entities." Several respondents requested increased access to clickers, adapters for their laptops so that they can connect to teaching podiums and in-classroom equipment, and more widespread adoption of one system while eliminating old ones (e.g., Windows XP): "being provided a clicker and adapters to connect personal laptops to teaching computers are often things that are required to be purchased by graduate students but could be placed in classrooms." Survey respondents also emphasized the need for more logistical support, including more in-person workshops to discuss effective teaching practices, access to peer review platforms, access to organization software (e.g., Obsidian), in addition to increased in-class management support from undergraduate TAs: "Short course to teach importance of teaching and what to expect from students"; "Undergraduate teaching assistants to help with classroom management/some grading." Several respondents indicated an interest in "Templates for organization of emails, [student] accommodations" to ensure communication consistency. In addition, more guidance on providing feedback and advice that is compliant with course policies, university policies, and the law was requested (e.g., attendance, assignment make-up opportunities, duty to report obligations).

4. Discussion

In this study, GTAs were able to identify several departmental and institutional initiatives/programs that support their teaching effectiveness but also indicated a lack (or absence) of awareness of these opportunities. In addition, when identified, these programs and initiatives were not always perceived as being relevant and/or accessible to them. GTAs recognize a need for more teaching-related orientation, discipline-specific training, and more opportunities for feedback on their teaching practices. GTAs also desired access to relevant technology to support their teaching, clearer communication of resources, and monetary incentives for participating in professional development initiatives.

In the discussion that follows, survey data is considered within the context of GTA trends in higher education, the role of GTAs in supporting the educational missions of institutions, and workforce development.

4.1. GTAs in U.S. Higher Education and Current Training Gaps

GTAs play a pivotal role in supporting and advancing the educational mission of universities. Not only are GTAs often conducting their own independent research, completing graduate-level coursework, and engaging in discipline-specific professional development, they are also often teaching a variety of courses to undergraduate students across the curriculum (e.g., Figure 4). From 153 surveyed graduate schools, Rushin et al. (1997) reported that 97% of the institutions have GTAs serving in an instructional role with Sundberg et al. (2005) later reporting that the majority (>90%) of lab-based courses in the sciences were led by GTAs. Subsequently, Bettinger et al. (2016) reported that ~46% of undergraduate students attending four-year institutions encounter courses in which GTAs are their primary instructor. Figure 7 summarizes the distribution of GTAs across the U.S., with California, Michigan, New York, Illinois, and Texas employing the highest number of "teaching assistants, post-secondary".

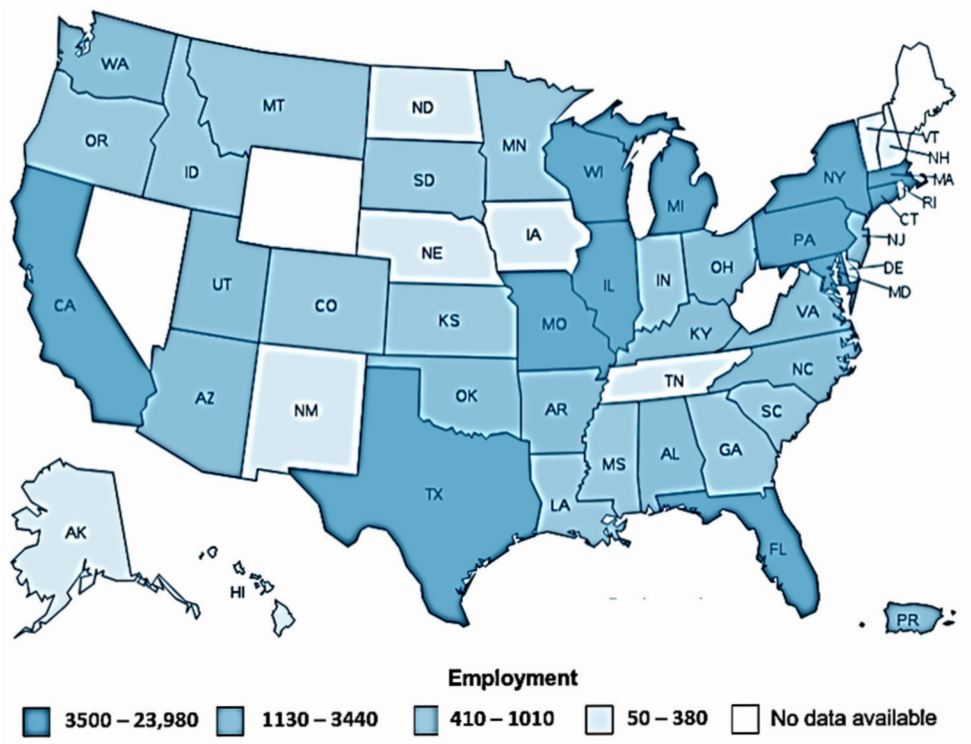

Figure 7. Distribution of "Teaching Assistants, postsecondary" employed across the U.S. as of May 2023. No data available for Maine, Nevada, West Virginia, or Wyoming. Modified from the U.S. Bureau of Labor Statistics (2023).

As discussed and shown, the role of GTAs is critical to an institution's workforce. From the survey responses of this work, GTAs dedicate 11–20 h/week (and more) to their duties and yet 75% have either never or seldom engaged with foundational, DBER literature. This represents a significant gap in their educational training and a missed opportunity to embed research-based pedagogy throughout the curriculum (e.g., Douin et al., 2024; Sarvary et al., 2025). For those who later in their careers are seeking faculty positions, the introduction to the DBER literature as a GTA would also work to introduce measures of teaching effectiveness and the potential connections between teaching, research, and service (in addition to other aspects; Batterton et al., 2024).

As also highlighted by the survey responses of this work, the offering and awareness of formal GTA training is clearly disparate, with some respondents engaging in opportunities offered through their departments and/or the Center for Teaching Excellence while others know of none. This is consistent with previous work where, despite the clear and significant

contributions of GTAs to the undergraduate experience and their critical role in supporting student learning, formal training and introduction to modern pedagogical practices are often lacking (e.g., Cicchino, 2020; Batterton et al., 2024). For example, Blouin and Moss (2015) reported that <55% of sociology departments offer GTA training and Schussler et al. (2015) reported that of biology departments surveyed, while 96% reported some form of mandatory preparation, only 52% required $\leq$10 h of annual GTA training.

4.2. Onboarding and Training GTAs: Potential Opportunities

With an increasing reliance on GTAs, the roles that GTAs have on undergraduate education will also increase. GTAs will impact undergraduate students' choice of major, their learning, their professional development, and contribute to their overall college experience (Park, 2004; Bond-Robinson & Rodriquez, 2006; O'Neal et al., 2007; Bettinger et al., 2016; Huffmyer & Lemus, 2019; Dillard et al., 2024). All of these components are crucial to undergraduate student retention and success. However, GTAs must balance their teaching roles with their other responsibilities. Professionally, and as part of degree requirements, these include completing required coursework, taking qualifying exams, and preparing and publishing original scholarly work (e.g., Ed.D., M.A., M.S., MBA, Ph.D.; Pyke & Sheridan, 1993; McMillan-Capehart & Adeyemi-Bello, 2008; Dolan & Johnson, 2009; Horowitz & Christopher, 2013; Bartkowski et al., 2015; Arsenault et al., 2021; McLaughlin et al., 2024). Responsibilities may also include serving as peer mentors, mentoring undergraduate research, completing additional training related to their career development (e.g., skill certification, software development), and serving as student representatives on committees at the department, university, and/or discipline level. In addition, GTAs may also encounter challenges navigating their relationship with their primary research advisor and interactions with their cohort (e.g., Lechuga, 2011; Schlosser et al., 2011; Curtin et al., 2013; Blanchard & Haccoun, 2019; Breen et al., 2024; Friedensen et al., 2024; Wilkins-Yel et al., 2024). This places GTAs in very difficult positions with variable support from their departments, divisions, or universities (e.g., Oswalt & Riddock, 2007; Gilmore et al., 2016; Evans et al., 2018; Collier & Blanchard, 2023; Yoo & Marshall, 2025).

Variable support also exists within the context of teaching and related training despite teaching often being a critical component of a GTAs employment (Finch & Fernández, 2014; Blouin & Moss, 2015; Marx et al., 2015; Innocente & Baker, 2018; J. E. Sutherland et al., 2022; Knezz et al., 2024). While some departments and/or universities offer GTA training via onboarding programs and pre-semester workshops, there is generally a lack of continued mentorship. From Chiu and Corrigan (2019) this continued support is just as important for GTAs as pre-service training opportunities on teaching instruction. These issues were also reflected in the GTA survey data collected in this study, where GTAs reported a need for more discipline-specific training.

Table 1 summarizes the themes identified in this study's GTA survey. As shown, while some GTAs were able to identify existing initiatives that support their roles, disparities between departments and/or programs exist. Institutions of higher education should therefore work to coordinate and communicate relevant GTA training opportunities. Additionally, individual programs should identify the specific needs of their GTAs in order to best support their professional development.

Table 1. Summary of themes and supporting context from GTA survey.

Theme	Supporting Context and Example Responses
Lack of coordinated and sustained GTA training/lack of awareness and relevance	Little or no knowledge of existing GTA training and professional development opportunities and/or their relevance to GTA-specific needs: "none I am aware of" "I cannot name any" "I am not familiar with what is here" "teacher development training–is not geared towards TA positions and is intended for those going into academia" "There are workshops at the center for teaching excellence but they don't seem to be geared for graduate students"
Existing initiatives that support GTA development	Peer mentoring within departments, departmental seminars focused on GTA needs, seminars and workshops offered by the CTE: "peer mentoring" "peer and teacher observations" "Graduate Onboarding" "Pedagogy Seminar at the start of my first year" "The Certificate of College Teaching" "webinars and workshops on specific aspects of teaching"
Requested program-level support for GTA preparation	Increased offering of pre-semester orientations with sustained professional development throughout the semester which is tailored to need: "would be very helpful to receive teaching feedback from students in a more timely manner" "A more concrete orientation for graduate students" "More workshops on teaching software like TopHat and Canvas functionality hosted by CTE or departmental entities." "education seminars or workshops for those who teach upper-level courses"
Resources to aid in course logistics	Teaching support tools (and training) to aid in the classroom (or lab): "More training on canvas and other software related to teaching" "being provided a clicker and adapters to connect personal laptops to teaching computers" "Templates for organization of emails" "(e.g., federal attendance requirement, building Canvas, how to add/drop students, how to put in midterm or final grades, etc.) would be helpful."
Strategies to support GTA investment and role ownership	Including GTAs in TA-related decisions and offering incentives, and rewards, to support GTA professional development: "Allowing GAs to have more input in which class they are assigned to" "more incentives for participating in teaching effectiveness initiatives/programs at Miami–ideally monetary (especially for us graduate students)." "Trainings for graduate assistants and reward for them"

Within the context of requests for additional GTA training as indicated by survey respondents, a wide array of programs supporting GTA teaching already exist throughout higher education. Such examples include a few days of orientation to semester-long courses in addition to microcredentials and certification programs (e.g., Kurdziel & Libarkin, 2003; Gardner & Jones, 2011; Dragisich et al., 2016; Smallwood et al., 2022; Brock et al., 2023). As summarized in Lang et al. (2020), and while acknowledging the impacts of such training can be variable, providing GTAs with professional development opportunities has been documented to improve their ability to assess student learning, their knowledge of instructional methods, their awareness of instructional design, and their self-efficacy. Some examples of teacher training programs at other U.S institutions of higher education

are summarized in Table 2. However, the time commitment associated with engaging in pedagogical training opportunities can serve as a challenge and a barrier for GTAs (e.g., Teasdale et al., 2019).

Table 2. Examples of GTA training programs at U.S institutions of higher education.

Type of Program	University
Workshops and seminars on teacher training	Johns Hopkins University, Michigan State University, Tufts University, University of Texas at Austin, University of Rochester
co-teaching programs	Princeton University, Stanford University, Yale University
pedagogically focused courses	Case Western Reserve University, Clarkson University, University of California Berkeley
teaching certificate programs	Brown University, Duke University, Ohio State University, Miami University, University of Michigan
preparing future faculty programs	Georgia Institute of Technology, Iowa State University, Howard University, University of Cincinnati, University of Florida, University of Southern Carolina, Virginia Commonwealth University
discipline-specific trainings via professional societies	American Association of Physics Teachers, National Association of Geoscience Teachers

From one survey respondent in this work, one option for institutions to consider is for all new GTAs to receive a reduced teaching assignment for their first semester. A teaching load reduction, similar to what pre-tenure faculty may receive their first semester (author McLeod, personal experience), would provide time for the following: full-semester teacher-trainings; shadowing more experienced GTAs in a variety of learning environments and course types; exploring and developing their own teaching philosophies; acclimating to their new roles while managing their own coursework and research obligations. In addition, this would provide time to build an interdisciplinary and transdisciplinary community with other new GTAs from across campus, perhaps through a GTA Community of Practice (CoP) or a professional learning community, the benefits of which have been well-documented (Wenger, 1998; Fontaine & Millen, 2004; Weber et al., 2007; Hara & Schwen, 2008; Sánchez-Cardona et al., 2012; Tam, 2014; Pyrko et al., 2016; Bishop-Williams et al., 2017; Prenger et al., 2019; Townley, 2020; Mavri et al., 2021; Kleinschmit et al., 2023; Zamiri & Esmaeili, 2024).

As indicated by survey data from this study, GTAs are integrated into a variety of course types from introductory labs to upper-level labs (see Figure 4). An approach to supporting GTAs in their new roles would be to pair a new GTA with a more experienced TA, at least for the first 3–4 weeks of the semester. By shadowing their peers, new GTAs would benefit from observing teaching styles, approaches to classroom management, grading norms, and gain direct insight into common challenges and how to address them, both in person and via email or LMS correspondence (e.g., Geragosian et al., 2024). This peer-to-peer learning approach would also facilitate knowledge transfer, establish a culture of mentoring, contribute to fostering a collaborative learning environment within a graduate program, and support GTA self-efficacy (e.g., Joyce & Hassenfeldt, 2019; Benedetti et al., 2022). This ultimately benefits undergraduate student learning by providing access to multiple perspectives and a potential opportunity to engage with a near-peer (and potential role model) who in some cases was themselves an undergraduate student <6 months prior and with whom they also share an identity or identities (e.g., Jackson, 2013; Rainey et al., 2018; Lusher et al., 2018). Pre-semester training and teacher-related orientations serve as another approach to equipping GTAs with pedagogical training for GTAs who are new

in their graduate program. However, new GTAs must navigate an array of orientation events, cultural changes, and new environments. These include, but are not limited to, institutional-level and departmental-level welcome events, moving in to new accommodation (potentially from out of state or out of country), completing employment-related paperwork in-person (e.g., I-9 forms in the U.S.), and familiarizing themselves with local resources such as grocery stores, post offices, gyms, pharmacies, hospitals, banks, sometimes without a vehicle. Furthermore, international GTAs are navigating a (potentially) significantly different educational system with additional visa and work authorization requirements as part of their employment, both of which can produce additional stressors (Özturgut & Murphy, 2010; Tran et al., 2022). One challenge associated with potentially moving any formal GTA-related training earlier is that in many cases, GTAs are not contractually required to start any work related to their position until one week before the academic year begins.

An option for pre-semester training for new GTAs may be to offer, at the departmental level, a series of informal virtual workshops led by current GTAs in the lead up to the start of the academic year. This would also work to establish a culture and expectation of peer teaching and peer mentoring early (e.g., Lorenzetti et al., 2019; Joyce & Hassenfeldt, 2019; Paolucci et al., 2021; Liu et al., 2022; Benedetti et al., 2022). While attendance would not be required, these virtual meetings could be recorded and provided as an optional (but highly encouraged) resource in advance, thus facilitating access across borders. In addition, to facilitate knowledge exchange and increase the transparency of expectations regarding their new roles as GTAs, once teaching assignments are known (see below), course materials could be shared in advance. This would contribute towards establishing a training and learning environment in which GTAs feel supported in their new roles and could support reducing some anxiety related to teaching (Roach, 2003; Cho et al., 2011; Chiu & Corrigan, 2019; Shum et al., 2020; Musgrove et al., 2021; Ozdemir & Papi, 2021). From Xu et al. (2024), it was found that GTAs acquire higher levels of confidence about teaching when training programs span several weeks compared with programs that last only a few days or less. Teaching demonstrations and actively practicing teaching were reported as the most effective methods to impart confidence in teaching. Other active learning practices that increased GTAs confidence in teaching included the development of teaching materials and reflecting on and practicing teaching strategies.

Some first-year GTAs may bring knowledge of TA roles with them having served as undergraduate TAs (e.g., Crowe et al., 2013; Philipp et al., 2016; Luckie et al., 2019; Hastings et al., 2024). This is a valuable experience that has likely provided new GTAs with unique insights into course design, classroom management, and peer learning. Having already served in TA roles, they may be more aware of which approaches to teaching are more effective for student learning (e.g., collaborative learning, project-based learning) and may have already completed some teaching-related professional development (e.g., Ritchey & Smith, 2019). When graduate programs are working on assigning courses and teaching-related duties, incoming GTAs should be provided with opportunities to share their UTA experiences (e.g., via a pre-program survey). This would allow graduate programs to evaluate which GTAs may already be prepared for independent roles and/or duties in specific types of learning environments (e.g., flipped classrooms) thus helping match GTA skill sets with instructional needs. A similar approach could also be taken throughout a GTAs career where prior to each semester, they are surveyed for their TA interests (e.g., introductory level lab, upper-level lab). This would not only provide GTAs with agency in this component of their professional development, as was suggested in the survey results of this study (see earlier), but also the opportunity to apply new knowledge and skills to new learning environments as a result of completing teaching-related workshops and training.

4.3. GTA Training Through Cognitive Apprenticeship: Career-Readiness and Workforce Development

The time challenges GTAs encounter can be further compounded in an environment where teaching is viewed as a research trade off and GTA professional development is not a priority, despite GTAs being critical to a department and institutions educational mission (e.g., Ethington & Pisani, 1993; Brownell & Tanner, 2012; J. E. Sutherland et al., 2022). For decades, the apprenticeship model has been applied to GTA training, particularly within the context of preparing future faculty (e.g., Coy, 1989; Nyquist et al., 1991; Lambert & Tice, 1993; Austin, 2002; Park, 2004; Kost, 2008; Walker et al., 2008; K. A. Sutherland, 2009). As discussed in Korpan (2014), evaluation of apprenticeship models has concluded that "on-the-job experience" is more effective when training is intentionally planned and directly supported by mentors who are formally assigned to oversee the training. Translating this to an academic context, GTA professional development should continue to move away from the traditional apprenticeship model and toward a cognitive apprenticeship approach (Wheeler et al., 2015; Doucette et al., 2020; Minshew et al., 2021). This requires the scaling-back of short-term training and the design and implementation of professional development grounded in learning theory (Morgan, 2002; Dennen & Burner, 2007; Young & Bippus, 2008; Hardré & Burris, 2012; Zhu et al., 2013; Korpan, 2014; Becker et al., 2017; Flaherty et al., 2017; Lang et al., 2020; Smallwood et al., 2022).

Within a cognitive apprenticeship framework, GTA trainers and mentors (e.g., faculty) are encouraged to make transparent their implicit cognitive processes and instructional practices. This facilitates the establishment of a structured professional development program for GTAs, providing time for scaffolding, preparation, discussion, and continued feedback while supporting student self-efficacy and skill development (e.g., Greer et al., 2016; Olsen et al., 2020; Pittaway et al., 2023). This optimal learning environment promotes GTAs development of expertise: they become experts over time by acquiring skills, applying critical thinking, problem solving, exploring their own teaching philosophies, reflecting, and implementing explicit teaching strategies, all while having the agency to learn from mistakes (Collins & Kapur, 2014; Ahn, 2016; Minshew et al., 2021; Shah & Raj, 2024). Furthermore, this cognitive apprenticeship approach supports graduate student socialization which itself is a critical component of graduate education more broadly (Bragg, 1976; Weidman et al., 2001; Austin, 2002; Austin & McDaniels, 2006; Austin, 2009; Exter & Ashby, 2019). In their review of STEM graduate education, Minshew et al. (2021) found three examples of where program development had used the cognitive apprenticeship framework to support graduate student professional training to some degree (Hwang et al., 2009; Greer et al., 2016; Yerushalmi et al., 2017). Specific examples include opportunities for students to develop research and non-research skill competency in low-risk environments, building student self-confidence, establishing Communities of Practices, and designing opportunities for self-reflection. Collectively, these support student self-efficacy (Greer et al., 2016).

In 1993, in the U.S., the Council of Graduate Schools (CGS) and the Association of American Colleges and Universities (AACU) launched a national-level Preparing Future Faculty (PFF) initiative. For a decade, grant funding supported the launch of PFF programs at >45 PhD-granting institutions and ~300 "partner" institutions (https://preparing-faculty.org/). These initiatives continue to exist across the U.S. today (e.g., Duke University, Howard University Purdue University, Stanford University, University of Cincinnati, University of South Carolina). These PFF programs add value to a graduate students' (or post-doctoral researchers') educational training by providing intentionally designed experiences that support the transition to a faculty role across a wide range of institutional types (e.g., Gaff, 2002; Jones et al., 2004; Simmons, 2009; CGS, 2011; Hershock

et al., 2011; Diggs et al., 2017; Dias, 2023; Krsmanovic, 2024). A core component of these is the scholarship of teaching and learning (SoTL) including discipline-based education research (DBER) and student assessment of learning. These efforts have been supported through collaborative efforts between departments, colleges, and teaching and learning centers. From participant perspectives as reported in Lukes et al. (2023), participants in PFF programs report a greater sense of belonging within academia, increased instructor confidence, a greater interest in cross-disciplinary collaborations, and greater comfort in discussing their work with others. While funding at the scale of the initial PFF is no longer, future iterations of PFF programs should be designed to respond to changing student, faculty, and institutional needs, the changing landscape of higher education, and new knowledge as it relates to educational program development (CGS, 2011; Lukes et al., 2023).

Sinche et al. (2017) investigated the skills developed during PhD training across several scientific disciplines and their contributions to career outcomes and job satisfaction across a variety of careers. Their study reported that doctoral programs provided graduate students with skills that are indeed transferable across both academic and non-academic career pathways. Sinche et al. (2017) also found that PhD-trained employees generally had a high degree of job satisfaction. In the context of GTAs, McCormick (2025) and Peck (2025) list several skills honed from teaching that are translatable to other careers and which support broad workforce development. These include both oral and written communication (including public speaking), team management, critical thinking, problem-solving, using diplomacy in conflict resolution, creativity, emotional intelligence, collaboration, organization, research, and leadership, among many others. These skills strongly align with those that employers seek in potential employees across workforce sectors (Warner-Garcia, 2018). In addition, through feedback (e.g., peer evaluations, mid-course evaluations, end-of-semester course evaluations), GTAs also learn how to respond to feedback and criticism; they are encouraged to adopt evidence-based strategies for improvement and develop skills on how to best meet the needs of a diverse group of learners. Over the course of a GTAs career, this promotes continuous learning and reflection and enhances performance through the refinement of career-relevant skills.

Finally, Drezner and Pizmony-Levy (2021) highlight the importance of fostering a sense of belonging during a graduate students' program within the context of potential future alumni engagement. As pointed out by Drezner and Pizmony-Levy (2021), programs should recognize the links between a graduate students' experience while they are completing their degrees, the extent to which they feel they belong, and the impact these have on fostering a supportive alumni network. In addition to a lack of diversity within an organization and large class sizes, the co-curricula experience of a graduate student directly impacts belonging. As departments and institutions consider their short and long-term growth within an increasingly challenging educational landscape, alumni engagement and giving will continue to be critical and programs should reflect and potentially reconsider how to develop and maintain inclusive and supportive graduate student communities.

4.4. Study Limitations and Next Steps

The data and discussion presented have limitations that the authors acknowledge. The survey was conducted at a single R2 university in the US and so this may affect external validity. This will likely be the case for institutions of higher education where resources, as well as student and faculty populations, are different. For example, while this study took place at a predominantly white institution (PWI) where 80% of undergraduate students identify as white and <3% as international; the graduate student population is demographically different: 54% of students identify as white and 14% as international (as of 2024).

The 19% response rate introduces the potential for non-response bias, with an overrepresentation of survey respondents from the College of Arts and Science (80%). While this is the biggest college with respect to graduate student numbers at this institution (58%), this overrepresentation may influence how findings apply to other disciplines.

Future studies aiming to examine the experiences and perceptions of GTAs within the context of their training and workforce development pathways could therefore benefit from increased survey participation, more balanced representation from a range of disciplines, and perspectives from GTAs across various institutional types.

5. Conclusions

This study explored the perceptions and experiences of GTAs as it pertained to their workloads and professional development at a rurally located, R2 (Carnegie Classification) institution in the United States. As the number of GTAs that play a critical role in advancing the mission of higher education institutions increases, there is a growing demand for more formal training related to these roles. This includes more teaching-related training, opportunities for continuous improvement and reflection, in addition to initiatives that support GTA career pathways beyond graduation. From the survey data collected from 74 GTAs, a number of departmental and institutional programs that support the teaching effectiveness were identified; however, these were often perceived to be irrelevant and/or inaccessible. In line with the increasing demand, GTAs recognize their need for more teaching-related orientation, discipline-specific training, and more opportunities for feedback on their instructional practices.

While many universities provide this training and programs related to GTA teaching effectiveness, many are not formalized and/or lack assessment. Within the context of GTA training and longer-term workforce development, this could include formal teaching pedagogy training and classroom management (including discipline specific and teaching effectiveness assessment), mentorship from a peer and/or a faculty member, improved transparency around university resource availability and access, in addition to clear expectations from the department, division, and institution regarding the roles of GTAs. Potential strategies to support teaching development early in a GTAs career include the offering of pre-semester onboarding programs, which is supplemented by continued training throughout the academic year, opportunities to shadow more experienced GTAs, and a reduction in assigned teaching duties during their first semester. The duties and expectations of a GTA also do not exist in isolation and fostering a supportive environment in which GTAs can succeed both professionally and personally should be a priority for all graduate programs. This could be achieved via allyship, intentional mentoring, community-building, mental health initiatives, recognition of teaching-related achievements, in addition to offering multiple professional growth and reflection opportunities while working to continue, and increase, their financial support. These are critical components of a GTAs co-curricula experience and crucial for active alumni engagement in the future.

Ongoing and improved support for GTA professional development is an investment in an institution's educational mission and is recommended to be approached using the cognitive apprenticeship framework. This investment directly supports and enhances the undergraduate student experience, while simultaneously preparing highly skilled GTAs for an ever-increasingly competitive and challenging workforce landscape.

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Appendix A

Table A1. Survey and summary of response options.

Question/Statement for Evaluation	Response Options/Comments
1. Which college/division are you primarily affiliated with?	College of Arts and Science; College of Creative Arts; College of Education, Health and Society; College of Engineering and Computing; College of Liberal Arts and Applied Science; Farmer School of Business; Prefer not to respond; Not applicable
2. Do you teach primarily in a STEM field?	Yes; No; Prefer not to respond
3. Total years at Miami University: (enter a number)	Numeric response
4. What course modalities do you teach in a typical academic year? Select all that apply.	Online, asynchronous; Online synchronous; Hybrid; Face-to-face; Sprint; Prefer not to respond
5. In a typical academic year, I teach: (include separate course sections, do not include independent study)	1–2 courses; 3–4 courses; 5–6 courses; 7–8 courses; 8+ courses; Prefer not to respond
6. In a typical academic year, I teach courses that serve individual class sizes of: (select all that apply)	<12; 12–30; 31–50; 51–120; 121–200; 200+; Prefer not to respond
7. I estimate the time put towards my teaching in a typical week to be: (include class preparation, assignment/lecture development, course delivery, grading, course-related emails, student "office" hours). Do not include hours advising.	<5 h; 5–10 h; 11–20 h; 21–30 h; 31–40 h; 41–50 h; 51–60 h; 61 h+; Prefer not to respond
8. What type of courses do you teach in a typical academic year? Select all that apply.	Introductory-level lab; Intermediate-level class; Intermediate-level lab; Upper-level class; Upper-level lab; Graduate-level; Prefer not to respond
9. My teaching efforts are recognized and valued by my students	Strongly agree; Agree; Slightly agree; Slightly disagree; Disagree; Strongly disagree; Prefer not to respond

Table A1. *Cont.*

Question/Statement for Evaluation	Response Options/Comments
10. The efforts I put towards my teaching are valued in my department.	Strongly agree; Agree; Slightly agree; Slightly disagree; Disagree; Strongly disagree; Prefer not to respond
11. Are course materials shared within your department?	Yes, often and highly encouraged. Materials are freely shared, for example, through a shared drive; Yes, frequently if requested, for example, by new faculty members; Yes, to some extent although it is rare and materials are shared with hesitation; No; Do not know; Prefer not to respond; Other
12. How often do you consult peer-reviewed literature associated with discipline-based education research (DBER) to inform and enhance your teaching?	Very often (weekly); Often (every couple of weeks); Sometimes (at least once a month); Seldom (at least once a semester); Never; Prefer not to respond
13. What departmental informal or formal initiatives/programs exist to promote teaching effectiveness? (e.g., peer mentoring, DBER seminars).	[open response]
14. What divisional and institutional informal or formal initiatives/programs exist to promote teaching effectiveness?	[open response]
15. Do you have any ideas for initiatives/programs at Miami you would like to see in support of teaching effectiveness?	[open response]
16. What teaching support would be helpful? (e.g., software, equipment)	[open response]

1. agree—respondent's consent to participate in the survey
2. college—respondent's college/division affiliation
3. stem—whether respondent teaches a STEM field
4. years—respondent's year at Miami University
5. valued.by.department—whether respondent feels their teaching efforts are valued by the department
6. course.type—type of course respondent teaches in an academic year
7. course.mode—course modalities respondent teaches in an academic year
8. class.size—different class sizes of courses that respondent teaches in an academic year
9. course.load—number of courses respondent teaches in an academic year
10. hours.teaching—time per week that respondent puts towards teaching duties
11. valued.by.students—whether respondent feels their teaching efforts are valued by the students
12. materials.shared.freq—how respondent feels about the frequency of sharing materials in the department
13. materials.shared.other—text answer for how respondent feels about the frequency of sharing materials in the department
14. dber.freq—how often the respondent consults peer-reviewed literature associated with discipline-based education research (DBER) to inform and enhance their teaching

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