Reimagining the Role of Teaching-Focused Faculty in Research-Intensive Universities: The Evolution of Scholarly Expectations and Departmental Influence

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Abstract

Research-intensive universities aim to conduct cutting-edge research while providing the knowledge and skills necessary to prepare students to excel in their respective fields. As student enrollments surge, many institutions have turned to hiring teaching-focused faculty. In the University of California (UC) system, there exists a unique position known as the Teaching Professor or Professor of Teaching (TP/PoT). This position is tenure-eligible and members are required to engage in classroom teaching, scholarly activities, and service responsibilities. To shed light on the background characteristics, roles and perceptions of teaching-focused faculty in research-intensive institutions, we collected survey data from STEM TP/PoT faculty across the UC system. Our analysis shows that pre-tenure TP/PoTs place greater emphasis on scholarly activities relative to their peers who have been in the role for longer, but their training and the provided institutional resources may not align with expectation for scholarly activities. Additionally, we find that TP/PoTs who engage in research perceive that they have a more significant impact on their colleagues' teaching, underscoring the value of research, even for teaching-focused faculty. This study informs the evolving landscape of teaching-focused faculty within research-intensive universities and the means by which these institutions can support them.

INTRODUCTION

Over the past few decades, there has been a rise in the number of teaching-focused faculty hired within science, technology, engineering, and mathematics (STEM) programs at research-intensive colleges and universities (Bush *et. al.,* 2006). This has been driven in part in response to calls for increasing the inclusivity of STEM education in higher education both in the US (Kennedy & Odell, 2014; Marginson *et. al.,* 2013; NAS, 2007; Singer *et al.*, 2012) and globally (Olson & Riordan, 2012; PCAST, 2010; OECD, 2007). Due to the focus on STEM education, teaching-focused faculty may be able to address issues of instructional quality both through their own teaching as well as by serving as resources for their colleagues and their department's academic programs (Mitten & Ross, 2018).

Teaching-focused faculty are meant to be specialized both in regard to their professional responsibilities as well as their knowledge and expertise. The most well-established teaching-focused faculty position is that of the adjunct lecturer. As of 2016, part-time or full-time non-tenure track lecturers made up nearly 70% of higher education instructors (Data Snapshot, 2018), with nearly every level and type of institution utilizing lecturers as the predominant form of faculty (Data Snapshot, 2018). In contrast to this more traditional lecturer position, several institutions have also incorporated teaching-focused faculty who have responsibilities that go beyond classroom instruction (Bush et. al., 2011, 2013, 2016; Kezar & Maxey, 2013; Ehrenberg & Zhang, 2015; Harlow *et. al.,* 2022). In addition to instructional duties, these positions may require service and/or scholarly productivity in the educational space, creating faculty that more closely mirror traditional tenure-track research-focused faculty.

The University of California (UC) system's tenure-track, teaching-focused faculty position is the Lecturer with Potential Security of Employment (L(P)SOE), who are informally titled Teaching Professors or Professors of Teaching (hereafter referred to as TP/PoTs). Comprising roughly 10% of tenure-eligible faculty across the UC system, the promotion criteria for TP/PoT faculty reflect that of the Research Professor (which we define as the traditional academic tenure-track faculty position that is evaluated primarily on the strength of their research program) but with a greater emphasis placed on the value of teaching excellence (Harlow, *et. al.,* 2020, UC University of California, 2020). The TP/PoT role places instructional duties at the forefront, as evidenced by a larger course load and an expected focus on education beyond the classroom (e.g. an increased expectation to participate in pedagogy-focused professional development) (Harlow et. al., 2020). Just as Research Professors are required to engage in scholarship, service, and teaching, TP/PoTs must also pursue each of these endeavors to earn tenure. Like Research Professors, TP/PoTs are eligible for a variety of pre- (Lecturer with Potential Security of Employment (LPSOE)/Assistant TP/PoT) and post-tenure ranks (Lecturer with Security of Employment (LSOE)/Associate TP/PoT and Senior Lecturer/Full TP/PoT).

Theoretical Framework

We consider the roles and potential impacts of TP/PoT faculty in the context of the communities of practice theory (Bandura, 1977; Lave & Wegner, 1991; Mercieca, 2017; Wegner, 1999). Communities of practice are social groups where individuals with distinct expertise engage in mutual learning (Lave & Wegner, 1991; Wenger 1999). Members of a community of practice are bound through a shared activity or goal that they strive to achieve. The community's resources

and practices evolve accordingly and reflect the joint enterprise undertaken by the individual members.

In the university context, we conceptualize an academic department, composed of faculty who share similar training, professional responsibilities, and goals, as a community of practice (Bitzer, 2010; Wenger 1998; Wegner *et. al.,* 2002). Faculty members within the department play a primary role in shaping departmental goals, practices, and policies. As individuals with unique experiences and expertise, they must collaborate to reach shared agreements regarding departmental matters. Thus, perhaps unsurprisingly, academic departments are commonly recognized and treated as functional units of change within colleges or universities, contributing to both research and teaching endeavors.

In regard to the undergraduate education focus of our study context, Research Professors and TP/PoTs have a shared responsibility towards student success, and the content and quality of intradepartmental interactions likely impact the department's ability to provide for their students. As individuals expected to have educational expertise (Harlow et al., 2022), it stands to reason that their knowledge and experience may be shared with their departmental colleagues and help to shape the department as a whole as it considers undergraduate teaching and learning.

Research on TP/PoT Faculty

UC STEM TP/PoT faculty are primarily recruited to ease departmental teaching loads, ensuring consistent and high-quality instruction to meet the university's educational goals, and actively contribute to specialized teaching and service activities (Harlow et al., 2022; Harlow et al., 2020). Over time, administrators have increasingly recognized the broader contributions of these faculty

members beyond classroom instruction. This includes their role as pedagogical resources for colleagues, their capacity to secure external funding, and their active participation in education-focused scholarship (Harlow et al., 2022).

In addition to administrator perceptions, research has identified additional impacts of TP/PoT faculty. Denaro et al. (2022), utilized classroom observation data and cluster analysis to conclude that TP/PoT faculty's courses are more likely to be characterized as implementing active learning practices relative to Research Professor courses. Social network analysis conducted by Grunspan et al. (2021), revealed that TP/PoTs were more inclined to discuss teaching and offer teaching-related advice both within and across STEM departments, when compared to research-focused faculty. Furthermore, follow-up work from Wilton et al. (manuscript in prep) highlighted the influential role of TP/PoTs in pedagogical discussions related to diversity, equity, and inclusion topics.

Despite these positive impacts, research has also identified significant barriers to faculty in these teaching-focused positions. Administrators noted negative issues related to the formal TP/PoT position title (officially, Lecturer with Potential Security of Employment), and a lack of inclusion for TP/PoT faculty both in terms of their physical office location and their departmental rights and responsibilities relative to Research Professor, resulting in a "second-class citizen" status (Harlow et al., 2022). It was also noted that the criteria for TP/PoTs to earn tenure were also perceived to be ambiguous, particularly from the perspective of the Research Professors who were primarily tasked with evaluating their success (Harlow et al., 2022). Research has shown that these negative aspects of the position have led to a significant number of faculty within these

teaching-focused roles (30-40% from the cited studies) to considering leaving the position, the university, or even the field of education altogether (Bush *et. al.,* 2008, 2017, 2019).

In a 2017 survey of UC STEM TP/PoT faculty, it was noted that the roles and responsibilities within this faculty line were not uniformly distributed. Specifically, Assistant TP/PoT respondents indicated allocating a significantly greater portion of their time to scholarly activities compared to their tenured TP/PoT counterparts (Harlow et al., 2020). TP/PoTs of different rank also had different perceptions of what constituted scholarly activity, with Assistant and Associate TP/PoTs reporting discipline-education research (DBER) to a higher degree relative to those at the Full TP/PoT level (Harlow et al., 2020).

As the popularity of teaching-focused positions continues to increase nationwide (Bush *et. al,* 2008, 2011), we re-visited the characterization of the STEM TP/PoT position and the individuals within it. Specifically, we examined the following research questions:

1. What are the demographic characteristics and professional backgrounds of TP/PoT faculty and do these vary by faculty rank?
2. What are the scholarly responsibilities of TP/PoT faculty, and do these vary by faculty rank?
3. What resources are available for TP/PoT faculty to conduct scholarly activities?
4. How does engagement in scholarly activities correlate with the professional identities of TP/PoTs and their self-reported influence on colleagues?

Our analysis focuses on positioning TP/PoTs within the context of the research-intensive institution, whose mission is two-fold, conducting cutting-edge research and providing high quality educational experiences. These goals are often not aligned, as prior work has

demonstrated that there is little correlation between a faculty member's research excellence and teaching abilities (Hattie & Marsh, 1996, 2004), and an institution's finite resources must be divided between research and teaching activities (Bush *et. al.,* 2011; Sunal *et. al.,* 2001; Walczyk *et. al.,* 2007). Due to the expectation that TP/PoTs engage in both teaching and scholarly work, these faculty have the potential to bridge the university's missions by conducting educational research and then implementing their findings into practice. By better understanding TPs'/PoTs' perspectives and responsibilities around conducting scholarly activities, we aim to provide concrete recommendations for administrators who have the responsibility of supporting teaching-focused faculty and for junior scholars intending to pursue similar positions.

METHODS

This study was designed with the intent of identifying perceptions of the STEM TP/PoT faculty role within the UC system from the point of view of individuals within these roles.

Data Collection

Data was collected from the nine undergraduate-serving campuses in the UC system. Participants were identified through the University of California Office of the President's Academic Personnel office as individuals holding a TP/PoT faculty position. Surveys were distributed to participants via email in the fall of 2021 with information pertaining to the purpose of the survey and its use in this study. The survey was sent to 473 TP/PoT faculty, the total number of individuals within the position at the time the survey was released. The response rate was 63%**.** All data were collected in accordance with the University of California Irvine's Institutional Review Board (UCI IRB Protocol #1976)**.** While the survey went out to TP/PoT faculty in all disciplines, we are only including responses from those in STEM fields due to the persistent equity issues that pervade

these disciplines, and thus the potential impact that this position can have on addressing these issues. We define STEM according to the National Science Foundation definition, including the disciplines of biological sciences, physical sciences, computer and information sciences, geosciences, engineering, mathematics, and social, behavioral, and economic sciences.

While the survey was completed by 298 participants, we included responses for individuals who (1) were housed primarily within a STEM department and (2) who responded to at least 85% of the survey questions. After meeting these criteria, our sample size was 158 respondents.

The survey data presented here are part of a broader survey. For the specific research questions being addressed in this analysis, the following areas of the survey will be reported: demographic information, TP/PoT role responsibilities, resources available, perceived influence on colleagues' teaching practices, and professional identity. These questions can be found in the supplemental materials.

Demographic information. Participants were asked to provide demographic information including gender identity, ethnicity/race, first generation status, UC campus, department, rank, time in position, previous training, and identity as an instructor/researcher. Participants were asked to identify the types of formal and informal training they received both within their field as well as any training within education research fields. Formal discipline training within STEM fields included earning a graduate degree (Ph.D., master's degree) or working as a postdoctoral scholar. Formal education research training included earning a graduate degree or postdoctoral experience in either education or discipline-based education research.

TP/PoT Responsibilities. These items intended to understand participants' perception of the TP/PoT job expectations. To address this, participants were asked to provide an approximation

of the percentage of time they believed they spent participating in the three domains of responsibility: teaching, scholarship, and service as well as the percentage of their work time they felt TP/PoTs were expected to spend on activities in these domains. Furthermore, we acquired information on the types of scholarly activities they engaged in (e.g., generating peer reviewed publications, developing undergraduate curriculum, increasing departmental grant funds).

Resources available. This portion of the survey was intended to gather information on the types of resources available to those within the TP/PoT position such as training and support around scholarly activities, material support, start-up funds, etc.

Influence on colleagues' teaching. To determine to what degree TPs/PoTs believed they influenced their colleagues, we included three Likert-scale items to measure their perceived influence on colleagues' teaching beliefs, knowledge, and practices.

Professional identity: Participants were asked about the degree to which they identified as an instructor and separately as a researcher. This was reflected through a 7-point Likert scale measure of the degree to which one's professional identity overlapped with that of an instructor or researcher with one representing 0% overlap of personal identity and identity as an instructor or researcher and 7 being complete overlap with that of an instructor or researcher.

Data Analysis

All quantitative analyses, including two-sample t-tests and multiple regression analyses, were conducted in R (R Core Team, 2020). To compare the responses for a variety of survey items from newer faculty (Assistant TP/PoT) to tenured faculty (Associate or Full TP/PoT), a two-sample t-test was used to assess any statistically significant differences between the two groups. The decision to use two-sample t-tests reflects the exploratory nature of the analysis, where the goal

is to examine potential differences between new hires (Assistant TP/PoTs) and tenured faculty (Assistant/Full TP/PoTs) without specifying the direction of the expected differences beforehand. This approach provides a more open-ended examination of differences between new hires and tenured faculty, contributing to a richer understanding of the factors influencing faculty experiences in various stages of their careers.

Multiple regression analyses were run to explore the relationship between an individuals' research identity and engaging in scholarly activities as well as the relationship between an individuals' influence on colleagues teaching and engaging in scholarly activities. Predictor variables included engaging in scholarly activities, faculty's reported time spent on scholarly activities, generation of peer-reviewed publications, engagement in DBER, mentorship of undergraduate/graduate student researchers (all were used as dichotomous indicators of whether faculty participated in each of the listed scholarly activities), gender (dummy coded with male as the reference group), race/ethnicity (dummy coded white as the reference group), campus (dummy coded with Campus 1 as the reference group), department (dummy coded with biological sciences as the reference group), and faculty rank (a dichotomous variable with Assistant TP/PoTs as the reference group).

Qualitative coding was used to analyze open-ended responses for questions focusing on availability of resources, opportunities for research skill development, and perceived changes to the TP/PoT role. Through an iterative coding process, emergent codes were identified and categorized to determine frequency of response types.

RESULTS

Research Question 1: What are the demographic characteristics and professional backgrounds of TP/PoT faculty and do these vary by faculty rank?

As seen in Table 1, of the surveyed participants 43% identified as cis-gendered females. Most of the survey respondents identified as White (71.5%), with the second largest groups being Asian (5.7%) and Hispanic or Latina/o/x (5.7%). In terms of generational status, 24.1% were first-generation college graduates (defined by individuals whose parents did not complete a four-year degree in the United States). Our data demonstrates that the majority of TP/PoTs are employed across four of the nine undergraduate-serving UC campuses, with these accounting for 70.9% of employed TP/PoTs in our sample. TP/PoTs are distributed across STEM disciplines, with most respondents being concentrated in biological sciences (30.4%) computer sciences/engineering (29.7%), physical sciences (20.9%), and social sciences (10.8%); and the remaining 7.0% are in other STEM disciplines (which includes pharmaceutical sciences and statistics).

Table 1: Demographic data for STEM Professors of Teaching.

	Assistant TP/PoT		Associate/Full TP/PoT		Total	
	Count	%	Count	%	Count	%
Faculty Rank					-	-
Rank	77	48.7%	81	51.3%	158	100.0%
Gender Identity						
Cis-gender male/man	34	21.5%	41	25.9%	75	47.5%
Cis-gender female/woman	35	22.2%	33	20.9%	68	43.0%
Genderqueer, gender non-binary, transgender, or gender fluid	1	0.6%	1	0.6%	2	1.3%
Prefer not to answer	7	4.4%	6	3.8%	13	8.2%
Ethnicity/Race						
Asian	4	2.5%	5	3.2%	9	5.7%
Black or African American	1	0.6%	0	0.0%	1	0.6%
Hispanic or Latina/o/x	7	4.4%	2	1.3%	9	5.7%
White	51	32.3%	62	39.2%	113	71.5%
Multi-ethnic	5	3.2%	4	2.5%	9	5.7%

Other	2	1.3%	1	0.6%	3	1.9%
Prefer not to answer	7	4.4%	7	4.4%	14	8.9%
College-Graduate Status						
First-Generation College Graduate	14	8.9%	24	15.2%	38	24.1%
University of California Campus						
Campus 1	18	11.4%	17	10.8%	35	22.2%
Campus 2	11	7.0%	20	12.7%	31	19.6%
Campus 3	10	6.3%	14	8.9%	24	15.2%
Campus 4	13	8.2%	9	5.7%	22	13.9%
Campus 5	6	3.8%	6	3.8%	12	7.6%
Campus 6	7	4.4%	3	1.9%	10	6.3%
Campus 7	6	3.8%	3	1.9%	9	5.7%
Campus 8	1	0.6%	5	3.2%	6	3.8%
Campus 9	4	2.5%	3	1.9%	7	4.4%
Discipline (Home Department)						
Biological Sciences	25	15.8%	23	14.6%	48	30.4%
Computer Science/Engineering	20	12.7%	27	17.1%	47	29.7%
Social Sciences	12	7.6%	5	3.2%	17	10.8%
Physical Sciences	13	8.2%	20	12.7%	33	20.9%
Other STEM	6	3.8%	5	3.2%	11	7.0%

Demographic information for all TP/PoTs who responded to the survey (N=158). For college graduate status, the options were first generation college graduate or non-first-generation college graduate. For discipline, *other STEM encompasses pharmaceutical sciences and statistics.

Examination of the background training of TP/PoT faculty revealed the majority earned a PhD and received postdoctoral training in their departmental STEM discipline; with roughly 20% of TP/PoTs reporting earning degrees in an education/education research field (Table 2).

Table 2. Teaching Professors formal discipline-specific and educational training.

	Assistant PT/PoT		Associate/Full TP/PoT	
	%	Count	%	Count
Discipline Training				
Post Doc	38.2%	29	47.5%	38
PhD	96.1%	73	93.8%	75
Master's	1.3%	1	3.8%	3
Education/Education Research Training				
Education Post Doc	10.4% +	7	2.8%	2
Education PhD	10.4%	7	6.9%	5
Education Master's	2.8%	1	9.7% *	7

TP/PoTs' self-reported formal discipline-specific and education/education research training including postdoctoral training, Ph.D., or master's degree. The percentage and count of survey respondents in each category is reported. Two-sample t-test are used to report mean differences between new hires (Assistant TP/PoT) and tenured (Associate/Full TP/PoT) faculty ($^{+}$p=0.07, *p<0.05).

Prior work has demonstrated that the number of TP/PoT faculty has increased in recent years (Harlow *et. al.,* 2020); Figure 1 illustrates that 51.9% of our respondents were hired since the previous survey was distributed in 2017. Of these individuals, 98.7% reported being Assistant TP/PoTs.

Further examination of the professional training (Table 2) of these individuals based on their rank, reveals that there are significantly more tenured faculty (Associate or Full) with masters of education/education research (p=0.03), while newer faculty (Assistant TP/PoTs) are more likely to have post-doctoral experience in the field of education/education research (10.4% of newer faculty as compared to 2.8% of tenured faculty; marginally significant, p=0.07).

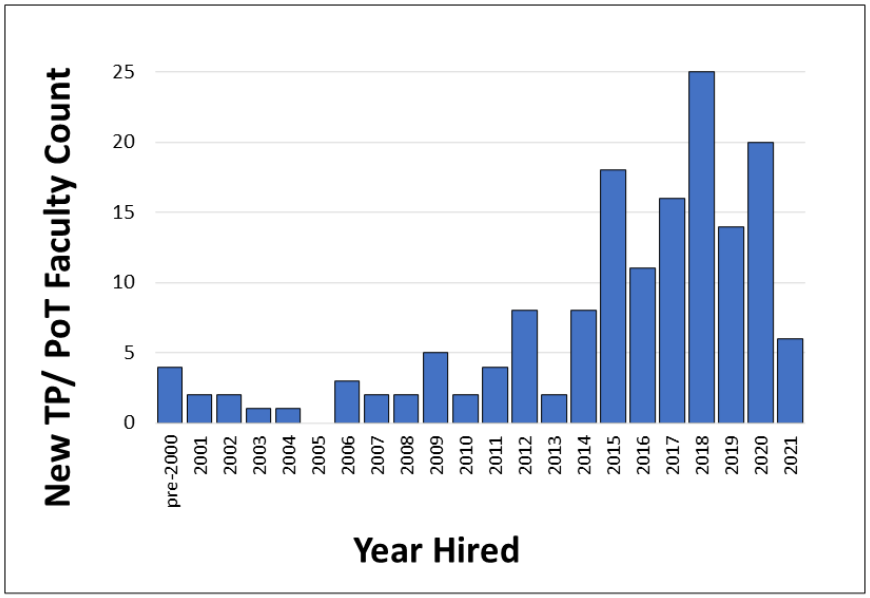

Figure 1. Hiring of Teaching Professors over the past 20+ years.

This bar graph illustrates the annual distribution of teaching professors hired over the past two decades. The x-axis represents the years in which individuals were hired, while the y-axis indicates the corresponding number of teaching

professors hired in each respective year. The data provides a comprehensive overview of the hiring trends, offering insights into the fluctuation and cumulative growth of teaching faculty appointments during this extended period.

Research Question 2: What are the scholarly responsibilities of TP/PoT faculty, and do these vary by faculty rank?

We were interested in examining whether the TP/PoT role is perceived differently by faculty based on their rank. We began by examining the percentage of time TPs/PoTs (not of a specific rank) perceived they were *expected to spend* on teaching, scholarly activities, and service (Table 3A). While there was not a difference between the expected time spent on service and teaching between Assistant versus Associate/Full TP/PoTs, Assistant TP/PoTs reported that faculty in this position are expected to spend significantly more time on their scholarly activities, aligning with prior results (two-sample t-test, $p<0.01$; Harlow et al., 2020).

Table 3: Professors of Teaching time spent on scholarly activities, service, and teaching.

A.	**Assistant TP/PoT**	**Associate/Full TP/PoT**
	% Time	**% Time**
Scholarship	19.77 (±8.18) **	16.08 (±8.97)
Service	15.14 (±7.58)	17.02 (±7.78)
Teaching	65.10 (±12.34)	66.90 (±11.22)
B.	**Assistant TP/PoT**	**Associate/Full TP/PoT**
	% Time	**% Time**
Scholarship	18.08 (±11.11) *	14.59 (±11.07)
Service	16.28 (±9.41)	22.91 (±11.78) ***
Teaching	65.64 (±14.15)	62.50 (±14.99)

(A) *Expected* time and (B) *actual* time spent on scholarly activities, service, and teaching.
These values are reported as average percentages (combined out of 100%). The standard deviation is presented in parenthesis (*p<.05, **p<.01, ***p<.001)

We then followed up on this question to identify the percentage of time that respondents in the various ranks *actually spend* on their teaching, scholarly activities, and service. Assistant TP/PoTs

reported that they spend significantly more time on scholarly activities (two-sample t-test, $p<0.04$) than their tenured colleagues (Table 3B), while Associate/Full TP/PoTs reported spending significantly more time on service (two-sample t-test, $p<0.001$).

These findings were reinforced through responses to the open-ended question, "How has the reality of being a TP/PoT been different from your expectations from when you were hired?" Examples included:

> "The research expectations have been much more than I expected." - *Assistant TP/PoT*
>
> "The expectations in the [Academic Personnel Manual] have changed since I was hired to include a larger role for research/scholarly activity." - *Full TP/PoT*
>
> "Expectations for this position have changed a great deal over the years - now an increased expectation for scholarly activity and service. But teaching is still considered the #1 priority" - *Full TP/PoT*

These responses highlight an increase in expectations around scholarly activities, specifically conducting research, since the respondents were hired. While mentioned by both pre-tenure and tenured TP/PoTs, almost twice as many Associate/Full TP/PoTs noted this increased expectation for scholarly activities in their open-ended response.

As the percentage of time spent on scholarly activities seemed to be a key difference between pre-tenure and tenured TP/PoTs, we were curious as to the specific activities these individuals engaged in (Table 4). Assistant TP/PoTs were more likely to report conducting education or discipline-based education research ($p<.001$) while Associate/Full TP/PoTs were more likely to report providing professional development for graduate students ($p=.02$) and K-12 teachers ($p=.005$) and developing undergraduate curriculum ($p=0.01$).

Table 4. Teaching Professors' self-reported activities.

A. Accomplished Activities	Assistant TP/PoT	Associate/Full TP/PoT
Discipline-based research	46.2%	41.6%
Discipline-based education research or education research	79.5% ***	53.9%
Mentoring undergraduate/graduate student research	70.5%	77.5%
Generating peer-reviewed publications	59.5%	62.9%
Improving teaching practices in the department/application of evidence-based teaching practices	69.2%	79.8%
Assessment of teaching/education in the department/campus	44.9%	62.9% *
Providing professional development for graduate students	37.2%	52.8% *
Providing professional development for K–12 teachers	6.4%	20.2% **
Developing undergraduate curriculum	67.9%	85.4% *

TP/PoTs' self-reported whether they did or did not engage in the above activities. The percentage of survey respondents in each category is reported. Two-sample t-test are used to report mean differences between new hires (Assistant TP/PoT) and tenured (Associate/Full TP/PoT) faculty (*p<0.05, **p<0.01, ***p<0.001)

Research Question #3: What resources are available for TP/PoT faculty to conduct scholarly activities?

As noted above, the majority of Assistant TP/PoT faculty reported conducting discipline-based education research. It is therefore important to understand whether TP/PoTs believe the university provided them with the necessary resources for success in this new endeavor, particularly since the overwhelming majority (79.1%) do not have formal training in this type of research.

To identify specific provisions provided to conduct scholarly activities, we asked TP/PoTs to share the amount of start-up funds they received and if lab space was provided to them when hired. On average, TP/PoTs reported receiving $38,700 (±$30,322) in start-up funds. Newer hires (Assistant TP/PoTs) received significantly more (two-sample t-test, p<.01) start-up funds upon hire - an average of $45,400 versus the average $29,000 that their tenured colleagues received. When surveyed about lab space, 51.2% of respondents reported needing lab space (55% of

Assistant TP/PoTs versus 47.6% of tenured faculty). Of those who reported needing lab space, only 37% of these individuals received it (34% of newer faculty and 42.5% of tenured faculty).

We then asked TP/PoTs about other types of support available to them to pursue scholarly work (Table 5). For the majority, they reported being able to supervise undergraduates (80.7%), having access to sabbatical (77.8%), having access to materials support in the form of equipment (45.5%), and receiving financial support to attend conferences/workshops (45.5%). Less common forms of support were access to postdoctoral scholars (20.5%) and scheduled reductions in their teaching responsibilities (16.8%). No significant difference was observed between the different faculty ranks for the types of support reported as available for scholarly work.

Table 5. Perception of resources and sources of support available to pursue scholarly work.

	Assistant TP/PoT		Associate/Full TP/PoT	
	%	Count	%	Count
Undergraduates working under your supervision	80.5%	62	82.1%	69
MS Graduate students working under your supervision	39.0%	30	41.7%	35
PhD graduate students working under your supervision	33.8%	26	32.1%	27
Postdoctoral scholars working under your supervision	19.5%	15	17.9%	15
Materials support in the form of equipment	45.5%	35	44.0%	37
Financial support to attend conferences and/or workshops	45.5%	35	50.0%	42
Sabbatical	67.5%	52	81.0%	68
Scheduled reduced teaching responsibilities	11.7%	9	19.0%	16
Other	7.8%	6	9.5%	8

TP/PoTs were asked to report whether or not the above resources where available for the pursuit of scholarly work. The percentage and count of survey respondents in each category are reported. Two-sample T-tests are used to report mean differences between new hires (Assistant TP/PoT) and tenured (Associate/Full TP/PoT) faculty.

While many respondents noted that these resources were available, the open-ended responses told a more complicated story:

"All of these are available to me, though the feasibility of obtaining them are more or less challenging (e.g., I'd need a large grant to be able to pay a postdoc... but I am technically "able" to)."

"All of these [referring to the dropdown options of resources] are possible, but in practice these are limited resources."

"Sabbatical is technically available but will be extremely difficult to take advantage of in practice."

These comments highlight that the technical availability of these resources did not necessarily translate to them being available in practice. Furthermore, when prompted to report on the availability of campus opportunities to improve their skills related to scholarly work, 60% of TP/PoTs reported that these resources were inadequate (no significant difference between non-tenured and tenured faculty responses). In comparison, only 7.5% of TP/PoTs reported that campus opportunities to improve their teaching were inadequate.

Research Question 4: How does engagement in scholarly activities correlate with the professional identities of TP/PoTs and their self-reported influence on their colleagues?

Thus far, differences have been identified in perceived behaviors amongst non-tenured and tenured teaching faculty, particularly in relation to the scholarly activity component of the position. To better understand how these differences may be related to perceptions of self, survey respondents were asked to report the degree to which they identified as an instructor and a researcher.

Table 6. Teaching Professors' identity as instructors and researchers.

	Average Alignment Score (STDEV)	
Identity alignment with:	**Assistant TP/PoT**	**Associate/Full TP/PoT**

Being an instructor	5.84 (± 1.12)	5.83 (± 0.99)
Being a Researcher	4.00 (± 1.65) **	3.28 (± 1.59)

A value of 1 indicated no overlap between an individual's identity and that of a researcher while a 7 indicated complete overlap. These values reported are the mean responses for the given group. The standard deviation is presented in parenthesis. Two-sample t-test are used to report mean differences between new hires (Assistant TP/PoT) and tenured (Associate/Full TP/PoT) faculty (*p<0.05, **p<0.01, ***p<0.001).

Assistant and Associate/Full Teaching Professors reported nearly identical perceptions when it comes to their identity as instructors (Table 6). This is in alignment with the TP/PoT position being primarily teaching focused. However, when asked about their identity as researchers, Assistant TP/PoTs identify significantly more as researchers than their more senior colleagues (p=0.006). To better understand the difference in research identity for Assistant and Associate/Full TP/PoTs, a multiple regression analysis was run to uncover factors contributing to research identity (Table 7). Engaging in discipline-based education research was a significant predictor of research identity (p<0.01). Engagement in any other scholar activity did not predict their research identity, nor did TP's/PoT's instructor identity, demographics, or their UC campus.

Table 7: Specific scholarly activities are predictive of an individuals' Researcher identity.

Variable	β	S.E.	P-value	
Intercept	2.49	1.00	0.01	*
Activities				
Discipline-based research	0.21	0.30	0.49	
Discipline-based education research or education research	0.88	0.32	0.01	**
Mentoring undergraduate/graduate student research	0.38	0.32	0.24	
Generating peer-reviewed publications	-0.12	0.33	0.73	
Improving teaching practices in the department	-0.55	0.40	0.17	
Assessment of teaching/education in the department/campus	-0.06	0.30	0.84	
Providing professional development for graduate students	0.48	0.35	0.17	
Providing professional development for K–12 teachers	-0.14	0.43	0.74	
Developing undergraduate curriculum	0.06	037	0.88	
Gender				
Cis-gender female/woman	0.39	0.33	0.24	
Genderqueer, gender non-binary, or gender fluid	0.57	1.26	0.65	
~~Prefer not to answer~~	~~-1.54~~	~~1.30~~	~~0.24~~	

Ethnicity			
Black or African American	-1.68	1.76	0.34
Asian	0.23	0.66	0.72
Hispanic or Latina/o/x	0.07	0.64	0.91
Multiethnic	-0.11	0.54	0.84
Other	1.70	1.22	0.17
Campus			
University 2	0.42	0.84	0.62
University 3	-0.17	0.82	0.84
University 4	0.50	0.90	0.58
University 5	1.37	0.93	0.14
University 6	0.76	0.79	0.34
University 7	0.91	0.81	0.25
University 8	0.94	0.93	0.32
University 9	0.19	0.99	0.85
Department			
Physical Sciences	-0.60	0.73	0.17
Social Sciences	-0.14	0.46	0.77
Computer Science/Engineering	-0.16	0.39	0.68
Other STEM	0.42	0.61	0.49
Faculty Rank			
Rank	-0.28	0.30	0.34

Residual standard error: 1.596 on 122 degrees of freedom (26 observations deleted due to missingness). Multiple R-squared: 0.2433. Adjusted R-squared: 0.05727. F-statistic: 1.308 on 30 and 122 DF. p-value: 0.1562. **Note:** *p<0.05, **p<0.01, ***p<0.001.

TP/PoT faculty are expected to improve undergraduate STEM education, both through their own teaching as well as through influencing their department (Harlow *et. al.,* 2022). As their departmental colleagues are predominantly Research Professors, we were curious to see whether a TP/PoT's engagement in scholarly activities correlated with their influence on colleagues' teaching beliefs, knowledge, and practices. When addressing influence on teaching beliefs, we saw no correlation between engaging in numerous scholarly activities and influence. However, when we examined influence on teaching knowledge and teaching practices (Table 8) we saw, of the independent variables that were modeled, a significant positive relationship between generating peer-reviewed publications (teaching knowledge: $p<0.05$; teaching

practices: p<0.05) and engaging in DBER (teaching knowledge: p=0.01; teaching practices: p=0.01). On the other hand, we see a negative correlation between engaging in mentorship of undergraduate and graduate student researchers and influence on their colleagues' teaching knowledge and teaching practices (p=0.02 and p=0.07 respectively).

Table 9: Specific scholarly activities are predictive of an individual's influence on colleagues' teaching knowledge and practices.

	Teaching Knowledge				Teaching Practices			
Variable	**β**	**S.E.**	**P-value**		**β**	**S.E.**	**P-value**	
Intercept	2.76	0.62	2.32E-05	***	2.51	0.59	5.11E-05	***
Activities								
Discipline-based research	0.17	0.20	0.39		0.09	0.19	0.63	
Discipline-based education research or education research	0.58	0.21	0.01	**	0.54	0.20	0.01	**
Mentoring undergraduate/graduate student research	-0.50	0.21	0.02	*	-0.36	0.20	0.07	+
Generating peer-reviewed publications	0.46	0.22	0.04	*	0.45	0.21	0.03	*
Improving teaching practices in the department	0.10	0.26	0.69		0.28	0.25	0.25	
Assessment of teaching/education in the department/campus	0.10	0.20	0.63		-0.09	0.19	0.62	
Providing professional development for graduate students	-0.07	0.22	0.73		-0.28	0.22	0.20	
Providing professional development for K–12 teachers	0.28	0.28	0.33		0.22	0.27	0.42	
Developing undergraduate curriculum	-0.24	0.25	0.35		-0.30	0.24	0.20	
Gender								
Cis-gender female/woman	-0.19	0.22	0.38		-0.08	0.21	0.70	
Genderqueer, gender non-binary, or gender fluid	-0.70	0.77	0.36		-0.51	0.72	0.48	
Ethnicity								
Black or African American	-	-	-		-	-	-	
Asian	-0.42	0.41	0.31		-0.13	0.38	0.62	
Hispanic or Latina/o/x	0.55	0.40	0.17		0.19	0.37	0.62	
Multiethnic	-0.04	0.33	0.92		-0.02	0.70	0.76	
Other	-0.25	0.75	0.74		0.22	0.70	0.76	
Campus								
University 2	-0.14	0.53	0.80		-0.07	0.50	0.90	
University 3	0.00	0.51	0.10		-0.02	0.48	0.97	
University 4	0.15	0.57	0.79		0.38	0.54	0.48	
University 5	0.91	0.57	0.11		0.46	0.53	0.39	

University 6	-0.04	0.49	0.94	0.09	0.47	0.85
University 7	-0.30	0.51	0.55	-0.10	0.48	0.84
University 8	-0.11	0.57	0.85	0.36	0.54	0.50
University 9	0.54	0.61	0.38	0.69	0.57	0.28
Department						
Physical Sciences	-0.14	0.28	0.62	-0.04	0.26	0.85
Social Sciences	-0.30	0.31	0.34	-0.14	0.30	0.64
Computer Science/Engineering	-0.50	0.40	0.22	0.08	0.23	0.73
Other STEM	-0.50	0.40	0.22	0.32	0.41	0.45
Faculty Rank						
Rank	-0.01	0.19	0.36	-0.07	0.18	0.71

Residual standard error: 0.97 on 107 degrees of freedom (42 observations deleted due to missingness). Multiple R-squared: 0.3169. Adjusted R-squared: 0.137. F-statistic: 1.711 on 29 and 107 DF. p-value: 0.025. **Note:** *p<0.05, **p<0.01, ***p<0.001.

DISCUSSION

Many of the current STEM educational approaches result in inequitable retention outcomes for students of different demographic backgrounds. These instructional approaches have resulted in a STEM workforce that is considerably less diverse than the initial, matriculating student population at American universities (NSF, 2019; NRC, 2012). In response, research has identified a variety of potential interventions at the student, course, and institution level to create more inclusive and equitable learning environments. One such method to aid in the implementation of these interventions could be through the integration of teaching-focused faculty into undergraduate programs. As teaching-focused faculty are becoming more prominent in higher education, it is essential that we better understand how to leverage and support these individuals. While our results are presented in the context of a position specific to the University of California, the conclusions and recommendations from this study can be implemented more broadly.

The TP/PoT role begins to evolve with new expectations. In order to contextualize the outcomes of this survey, it is essential to first consider the prior survey (Harlow et al., 2020) that initially characterized faculty in the TP/PoT position within the UC system, More specifically, this study reveal nuanced shifts in the position over time (Harlow et al., 2020), offering a valuable snapshot that laid the groundwork for future investigations into the potential institutional impact of these individuals. Since the initial survey, the number of faculty appointments in the TP/PoT role has notably increased; however, the demographic composition of these faculty members has remained relatively consistent (Harlow et al., 2020). Contrastingly, there has been a noteworthy rise in education/education research postdoctoral training among the newer faculty members (Assistant TP/PoTs). Like Harlow et al., 2020, there was no significant distinction in the perceived expectations for service and teaching between non-tenured and tenured faculty (Table 3). However, as in the prior study, there is a notable difference in the percentage of time Assistant TP/PoTs believe faculty in the TP/PoT position are expected to allocate to scholarly activities. Assistant TP/PoTs also disclosed that they spend significantly more time on scholarly activities than their tenured peers. Additionally, Assistant TP/PoTs are more likely to emphasize discipline-based education research as a form of scholarship relative to their tenured peers, mirroring the findings of our previous survey (Harlow et al., 2017). On the other hand, Associate/Full TP/PoTs invest significantly more time in service activities. The increase in the service commitments observed in tenured faculty is likely attributable to the expectation that service responsibilities expand in tandem with faculty rank and seniority (University of California, 2002, 2018).

Influence of scholarly activities on teaching-focused faculty's identity. This study sheds light on the unique professional identity dynamics among teaching-focused faculty at R1 research-

intensive institutions, introducing a nuanced perspective on the interplay between teaching and research identities. The study reveals that Assistant TP/PoTs identify significantly more as researchers than their tenured colleagues, with both groups noting a similar degree of instructor-identity, challenging the previously described notion that a strong research identity conflicts with a teaching identity (Connolly, 2012; Brownell & Tanner, 2012). This perception of a single dominant identity is also present in our context, as stakeholders are often surprised by TP/PoT involvement in research and continue to view teaching-focused faculty as instructors whose function is overwhelmingly to reduce the departmental teaching load (Harlow et. al., 2022). We speculate that the dual teaching/research identity may be specific both to the TP/PoT position as well as the institutional context in which this position is found, the research-intensive university. It would be interesting to examine how these identities change over time, particularly as individual TP/PoT faculty proceed through the faculty ranks and their daily responsibilities change, due to shifts in departmental priorities, personal choices, or general changes in STEM teaching and learning. Future work can also examine identity formation more broadly in STEM to see how experiences and institutional structures influence how graduate students, postdoctoral scholars, and faculty perceive their teaching and research identities.

Teaching Focused faculties scholarship positions them to influence pedagogy and instruction. One purpose for the increased hiring of teaching-focused faculty in STEM education has been driven in part by calls for addressing issues of instructional quality (Kennedy & Odell, 2014; Marginson *et. al.,* 2013; NAS, 2007; Singer *et al.*, 2012; Olson & Riordan, 2012; PCAST, 2010; OECD, 2007). Teaching-focused faculty have the potential to address these issues through innovation in their own teaching as well as by serving as instructional leaders/resources within

their department's academic programs (Mitten & Ross, 2018). In this context, we found a positive correlation between faculty engagement in scholarly activities (specifically generating peer-reviewed publications and participation in DBER) and their self-reported influence on colleagues' teaching knowledge and practices. This finding aligns with prior research that highlights the benefits of engaging in DBER, including providing instructors with the information they need to make informed decisions about pedagogy, instructional materials, and assessment practices, leading to more relevant and effective education (NRC, 2012).

We also observed a negative correlation between a faculty member's involvement in mentoring undergraduate and graduate student research and their impact on colleagues' teaching knowledge. This correlation may be attributed to the presence of competing demands and priorities. Faculty members who are deeply engaged in student research may invest substantial time and energy in this pursuit. Additionally, the nature of the mentee's research can further compound these demands. If faculty members spend a significant amount of time and energy on mentoring discipline-specific research, it may diminish their capacity to participate in activities like Discipline-Based Education Research (DBER). As a result, their efforts may not directly align with influencing colleagues' teaching knowledge or practices.

Exploring the Mechanisms of Influence within Communities of Practice. We aim to delve deeper into key aspects of the evolving role of STEM TP/PoTs and their broader impact on post-secondary education by leveraging the communities of practice theory (Bandura, 1977; Lave & Wegner, 1991; Mercieca, 2017; Wenger, 1999). Academic departments can be viewed as communities of practice (Bitzer, 2010; Wenger, 1998; Wegner et al., 2002), where TP/PoTs are embedded faculty who possess similar training, professional responsibilities, and goals as their

departmental colleagues. Illuminating the processes by which TP/PoT faculty earn influence and impact their colleagues is crucial for a deeper understanding of how faculty pedagogical beliefs and practices can be affected and change over time. This inquiry is particularly pertinent as institutions employ change strategies to enhance undergraduate STEM education, emphasizing the distinctive roles individuals and various position types play in effecting meaningful change within the community of practice (Bush *et. al.,* 2017; Bush *et. al.* 2020).

Recommendations for Hiring. A more recent emphasis on research *expectations* highlights a misalignment with TP/PoT hiring, as the overwhelming majority of those in the position do not have formal training in this arena. While there was a slight increase in Assistant TP/PoTs with an education or discipline-based education research PhD relative to associate or full level faculty (10.4% vs. 2.8%), this is clearly not a consistent requirement for those being hired in the role. Although a lack of education research training does not disqualify TP/PoTs from pursuing such research, it does put them at a disadvantage both in terms of their abilities to publish peer-reviewed work as well as obtain extramural funding. As such, we recommend hiring committees consider the importance of education research training if the TP/PoT being hired is expected to engage in this practice, particularly considering 60% of our survey respondents felt that their campus did not provide sufficient professional development opportunities for their scholarly activities, it seems even more important that new hires have these skills before entering the position. Similarly, for junior scholars interested in pursuing a teaching-focused faculty position, there appears to be value in having formal education-research training during one's graduate or postdoctoral experience. This aligns with the increased frequency of education research being

integrated into more traditional discipline-focused research programs (Singer *et. al.,*2012; Henderson *et. al.,* 2017; Daniel *et. al.,* 2022).

Recommendations of resources: Time and space to conduct research. As trained scientists, teaching-focused faculty can leverage their scientific training along with their educational background to not only conduct research on education within their discipline (American Physical Society, 1999; Bush *et. al.,* 2008, 2011) but also implement it in their instruction and influence their colleagues within their department (Woodin *et. al.,* 2010; Bush *et. al,* 2006, 2011). However, to do so, the proper resources must be provided. Beyond increased professional development opportunities, TP/PoTs who engage in research reported that they need more time to do so, specifically in the form of teaching relief. Furthermore, physical space to conduct research is also needed by many of the faculty. This point is purposefully underscored as there is a misconception that education-focused research does not require additional time or space, as it can be conducted within the classroom (Bush et. al. 2006). This ignores the fact that many education-focused studies are not classroom-related, and that a thriving research program requires a team of individuals who have the space to conduct their work in a collaborative fashion.

Despite the heightened expectations and increased investment of time in scholarly pursuits, TP/PoT faculty, no matter their rank, do not feel adequately supported. While several resources were indicated as available, numerous faculty members noted in open-response questions that their actual access to such resources was limited, with 60% reporting inadequate resources for scholarly work. Some of this is due to the need for external funding to access these resources.

Limitations. While this survey was sent to all individuals within the TP/PoT position across the University of California system, a self-selected group chose to complete the survey. While this

group was representative of the distribution of TP/PoT faculty by UC campus and discipline, we cannot claim that the survey responses fully represent the entirety of the TP/PoT population. Additionally, self-reported studies where individuals provide information about themselves, their behaviors, their perceived expectations, and their perception of influence, have several limitations that can impact the reliability and validity of the data collected. For example, in this specific study, there might be a tendency for participants to feel compelled to align their reported accomplishments with their perceived expectations. Moreover, certain questions, particularly those related to influence, lack precise definitions, potentially resulting in significant variations in how respondents interpret and respond to these specific inquiries. Having additional measures of influence, including surveying of departmental colleagues and measuring more objective outcomes like teaching practices, can add additional data to complement our survey items. Related to this, our findings regarding the relationship between research activity and influence are only correlational, and potentially reflect characteristics of a TP/PoT who conducts research or identifies as a researcher and is not related to the research activity itself.

Conclusion. Research-intensive institutions are invested both in conducting innovative research and developing the next generation of future scientists and leaders. Unfortunately, these two aims are often not complementary. This distinction in many cases is amplified by the merit or tenure process where faculty success is measured primarily by research excellence. However, by encouraging the research efforts of teaching-focused faculty, we may be able to bridge the gap between the research-focused and teaching-focused aims of the university, and in doing so, increase the influence teaching-focused faculty have on their colleagues' teaching. As this form of influence has been identified as one of the more significant goals of hiring TP/PoT faculty, we

believe that fostering an environment that promotes faculty success in their scholarly activities may also promote STEM student success.

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