

Using communities of practice to explore departmental values

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We use a communities of practice framework to explore how departments value different constituent groups, focusing on faculty, undergraduate, and graduate students. Through a collaborative, autoethnographic, contrastive case study of two physics departments, we analyze the inter- and intra-constituency interactions and shared practice of each community, demonstrating how each department centers or peripheralizes constituent groups. We argue that how each department enacts their community of practice demonstrates a foundational shared value: faculty autonomy for one and pastoral care of undergraduates for the other.

I. INTRODUCTION

There is a growing body of literature centered around questions of equity and inclusion within post-secondary education. One area that can contribute to this conversation is an exploration of our own cultures, activities, and practice, with particular attention to how we conceptualize working together within a community and value members of the community. The communities of practice framework [1] provides a human-centered perspective on this question by focusing on how interactions and practice center or peripheralize members of a community. In this paper, we present a collaborative, autoethnographic, contrastive case study of two US physics departments using the communities of practice framework to explore how different constituent groups within the department (faculty, staff, undergraduate students, and graduate students) engage with the departmental community. We see how different constituent groups are centered and from this analysis, we infer a foundational value that informs how each department enacts their community of practice.

We chose to focus on physics departments for multiple reasons. First, we are each a member of a physics department at a US institution and thus bring an insider perspective to the culture we are exploring. Second, there have been calls within physics to address issues of diversity, equity, and inclusion (e.g. [2], [3]) and better ways of describing and understanding physics department cultures can productively contribute to research on these issues. Third, there is not an accrediting body for physics degrees, unlike some disciplines (e.g., ABET for engineering [4], ACS for chemistry [5], or state credentialing for education). Thus, one might expect physics departments to have more variation than programs that are more explicitly pre-professional; physics departments are therefore more suited to a contrastive study. Finally, it is typically expected within physics that the majority of graduate students will be full-time students; work as graduate teaching assistants in undergraduate classes; choose their own faculty mentor; and conduct research that is explicitly related to their mentor's research. Thus, there is an expectation that members of each constituent group will significantly interact with other constituent groups, providing particular affordances for an analysis that explores inter- and intra-constituency interactions.

II. THEORETICAL FRAMEWORK: COMMUNITIES OF PRACTICE

Communities of practice is a sociocultural learning theory based on several fundamental assumptions: humans are social beings; knowledge is a matter of both competence with respect to and participation in valued enterprises; and making meaning is the goal of learning [1]. Within this framework, a community of practice (CoP) is a group of people that regularly interact in order to deepen their knowledge or expertise about a particular domain. A CoP can be effectively described by the *domain* of interest, the *community* interac-

tions, and shared *practice* that facilitate the group's effectiveness [6]. Framing learning as social participation shifts the study of learning to understanding how individuals participate in the practices of their communities and how communities refine those practices and acculturate new members [1]. This framework has been used in PER to students' physics identity development [7–10] and sense of community [11].

The communities of practice in this paper share a domain: academic physics in the United States. All members of the community, including faculty, staff, graduate students, and undergraduate students share an overall goal of enabling members of this community to contribute to our understanding of the universe. Thus, we will focus on articulating the community interactions and the shared practice that characterize these communities. In doing so, we highlight the ways in which a community of practice can center or peripheralize constituent groups within the community and what this tells us about their shared values.

III. METHODS: COLLABORATIVE AUTOETHNOGRAPHY

We used a collaborative autoethnographic approach, in which researchers work together to analyze and interpret autobiographical data [12]. A similar approach has been used in other areas of physics education research, for example to explore the space between theory and application in curriculum development [13]. This methodology embraces the inherent subjectivity of autoethnography while leveraging collaboration to gain multiple perspectives on the data and analysis [12]. As members of these departments, we are in a unique position to elucidate the cultures of which we are a part. Thus, our analysis is inherently self-focused and context conscious in that we are grounding our analysis in our own experiences within our particular local environments. In addition, our reflective analyses of these environments are enhanced and challenged by our interactions with each other, allowing us to maintain an approach that is both researcher visible and critically dialogic, helping us to hold in tension our dual roles as researcher and participant.

Our data were primarily individual and collaborative reflections on our own experiences within these departments. We framed our reflections by asking, "How do the different constituencies of our department interact?" To support and critique these reflections, we also relied on departmental data that are generally available to all faculty within the department (e.g., website descriptions, program review documents, enrollment statistics, etc.). We analyzed our reflections by categorizing the practices and comparing between the two departments.

The authors of this paper are a current graduate student and former staff member at PSU, a tenured faculty member at LCU, and a tenured faculty member at PSU. We shared this draft with other members of each department, including staff and faculty in both departments, graduate students at PSU,

and a graduate student who has been a member of both departments, and elicited feedback to verify that we were presenting an accurate picture of each department.

IV. RESULTS

A. Institutional contexts

Prairie State University (PSU) is a large (ca. 20,000 students), predominantly white, public, land-grant university. The Physics department offers bachelor's degrees in physics, a minor in physics, and an M.S. and Ph.D. in physics. The department has about 56 graduate students and about 50 undergraduate majors and minors. There are 26 tenure-line faculty, 7 instructional staff, 15 postdocs, and 18 support staff.

Large Catholic University (LCU) is a large (ca. 21,000 students), diverse, urban, private, Catholic university. The Physics and Astrophysics department offers bachelor's degrees in physics and astrophysics, a minor in physics, and an M.S. in physics. The department typically has about eight graduate students, 50 undergraduate majors, and 10 undergraduate minors. There are nine full-time faculty (eight tenure-line and one term) and an administrative assistant who is the sole full-time staff member.

While both departments are made of the same constituent groups (faculty, staff, graduate and undergraduate students) and have similar numbers of undergraduates, they are also different in ways that likely affect how they enact their CoP. PSU's physics department is larger overall, with more faculty, staff, and graduate students. PSU offers both M.S. and Ph.D. graduate degrees while LCU offers only an M.S. degree.

B. Community interactions

We compared the community interactions for these two departments, focusing on how the constituencies interact with each other (see Table 1). Both departments include many of the same types of interactions: teaching; undergraduate advising; faculty and committee meetings; research mentoring; departmental events; and student clubs. Across all interactions in both departments, all constituencies regularly interact with one another. Yet there are differences in the nature and frequency of those interactions that differentially center the constituent groups.

As one might expect for a university department, faculty are central to the community for both departments. However, even with intra-faculty interactions, we see a difference. At PSU, faculty meetings are focused on reports from the department head, whereas at LCU, there is more focus on issues of shared governance.

We see another significant difference in how the two departments position graduate students compared to undergraduate students, particularly evident in research mentoring, departmental events, and student clubs. Many of the interac-

tions at LCU specifically involve undergraduates resulting in a department where undergraduates are central with graduate students slightly more peripheral to the community. In contrast, graduate students at PSU are significantly more central than undergraduates. For example, both consider departmental events to be open to the whole department. However, LCU has events specifically targeted at the whole department, undergraduates, or graduate students, whereas at PSU most events draw only faculty and graduate students.

C. Shared practice

Community interactions affect and inform shared practice, and vice versa, in a mutually reinforcing way. Much of the shared practice in both departments focuses on educating students and preparing them for life after graduation. We categorize practice in terms of pedagogy, research, and other mentoring. From this shared practice, we find a focus on pastoral care for undergraduates at LCU and an emphasis on faculty autonomy and at PSU.

1. Pedagogy

In both departments, specific pedagogical practices vary significantly between courses. However, the LCU physics department explicitly chose to employ classroom practices that are student-centered. All departmental classrooms are designed in a studio or SCALE-UP style [14] and all classes, both graduate and undergraduate, involve collaborative activities during class (collaborative problem solving, group experiments, peer review, etc.). Conversely, outside of service courses, the PSU physics department does not have a standard curriculum or teaching practice, but generally uses faculty-centered modalities. Both departments train graduate and undergraduate teaching assistants through a required course (LCU) or summer orientation (PSU) and weekly prep meetings (LCU and PSU.) In addition, at LCU, all faculty maintain an open-door policy for student interactions beyond scheduled office hours. At PSU, this is at faculty discretion.

2. Research

Both departments place a strong emphasis on student research and their graduate programs require a thesis project supervised by a faculty member. At both institutions, there is variation in individual lab practices so we focus here on department level research practices and policies. At PSU, most graduate students are supported by faculty after their first year and faculty set their own pay rates. A yearly faculty meeting is devoted to discussing graduate students' progress. At LCU, most faculty cannot support graduate students, but do help them apply for internal or external funding.

TABLE I. Comparison of the community interactions at LCU and PSU. For each type of interaction, we include the constituencies (or groups) that are involved in the interaction (grad = graduate students, u-grad = undergraduate students). Constituencies in parentheses are occasional, but not expected participants in the given interaction.

Interaction	LCU		PSU	
	Groups	Description	Groups	Description
Teaching	faculty, grad, u-grad	Load is 1-2 courses per term, more undergraduate than graduate courses	faculty, grad, u-grad	Load is one course per term, more graduate than undergraduate courses
	grad, u-grad	Graduates TA throughout degree	grad, u-grad	Graduates TA 1st year and if not RAs
	faculty, grad, u-grad	All teaching faculty and graduates TAs hold office hours for students in their courses		
Undergraduate Advising	faculty, u-grad	All tenure-line faculty serve as undergraduate academic advisors	staff, u-grad	Undergraduates are advised by a staff advisor
Faculty and Committee Meetings	faculty, staff	ad hoc and ca. 3-6x/year. Discuss administrative activity (e.g., budget items, committee reports); teaching assignments; and emergent topics	faculty	Ad-hoc and ca. 8x/year. Discuss administrative activity (e.g., promotion and tenure review, review of graduate students); and receive reports from the department head.
Department Events	whole dept.	Faculty are expected to mentor undergraduates and graduates in research	faculty, grad, (u-grad)	Faculty mentor graduates and occasional undergraduates in research
	faculty, grad, (u-grad)	Thesis proposals and defenses	faculty, grad, (u-grad)	Colloquia, research seminars, thesis proposals and defenses
	faculty, (grad), u-grad	Research Day and year-end celebrations		
Student Clubs	u-grad, (grad), faculty	Each club (of several) meets on a regular or semi-regular basis and has a physics faculty member advisor.	u-grad, staff or faculty	Undergraduate club (singular) meets rarely, has faculty or staff advisor, and hosts department open house
			grad	Physics graduate club meets regularly

While PSU encourages undergraduates to participate in research, faculty are not required to have undergraduates working with them. In contrast, all faculty at LCU are expected to support undergraduates in research. Both institutions have internal programs that fund undergraduate research. The LCU physics department holds a departmental event (Research Day) designed to introduce undergraduates to research opportunities for the following summer and academic year. This event is scheduled to occur before the deadline for internal funding programs. The PSU physics department discusses undergraduate research during a required course that all first-year students take. Students are then encouraged to find a research project to join, and individual faculty members help students who work for them apply for funding. Both departments also encourage students to apply for external research opportunities (e.g., NSF's REU program). Announcements

about such opportunities are circulated to the undergraduate majors via staff and faculty will provide letters of recommendation and application support.

3. Other mentoring

The LCU physics department provides opportunities for students to present their research and create connections with the broader scientific community. The departmental administrative assistant is largely responsible for organizing LCU's Annual Undergraduate Research Showcase, as well as organizing departmental events and serving as a departmental photographer. Many of the physics faculty serve as reviewers for LCU's undergraduate research journal, with one serv-

ing on the editorial board. The LCU physics department also pays student membership fees for any STEM organization and funds both graduate and undergraduate students to attend professional society conferences to present their research. In addition, undergraduates are supported to attend professional development conferences even when not presenting research. At PSU, individual faculty, rather than the department, provide support for students to attend conferences and determine the amount of support and there is large variation in policies between faculty. The graduate staff assistant unofficially takes on the role of "grad mom," organizing formal and informal events for the department and graduate students as well as performing general non-research advising for grad students.

At LCU, individual faculty members have also taken up activities to help undergraduate students prepare for life after graduation. One offers an optional course for students preparing for the physics GRE and another has helped create makerspaces at LCU to provide opportunities for students to develop creative and technical skills. Two faculty work with student clubs, helping them to host events such as a Women in Physics Career Day.

D. Physical space

The physical space that a department occupies affects how the community housed within it develops and sustains community and shared practices. PSU and LCU each share their respective buildings with one other department, and each department houses research labs, instructional spaces, faculty offices, graduate student offices, administrative offices, and undergraduate study space in that building. However, PSU's physical space is distributed throughout the building (interleaved with the other department in the building) and LCU's departments are primarily concentrated by floor.

Both departments segregate their space by constituency: undergraduates study in the undergraduate study space and graduate students and faculty rarely enter the space. At LCU, the graduate students also have a separate space that is rarely entered by undergraduates or faculty. Almost all faculty offices are in the same suite, with the departmental administrative staff at the main desk. In contrast, at PSU, graduate students and faculty segregate by research group: students in the same research group share office space, and research lab rooms belong to specific research groups.

LCU's tight grouping of faculty and administrative space increases intra-faculty interactions. Candy provided at the main desk often encourages students to come to the office and interact and keeping all the faculty together increases the chances for undergraduates to interact with all faculty, rather than just the specific person they're visiting. Recently, the department has begun to think about how to reconfigure their space to better facilitate interactions between faculty, undergraduates, and graduate students.

PSU's segregation by research group decreases intra-

faculty interactions around pastoral care of graduate students outside of their research groups and of undergraduate students overall. Housing graduate students by group - and tying them to research labs by group - also decreases their availability to undergraduate students. Some efforts in the department to increase inter-group interactions have been stymied by this geographic separation.

V. DISCUSSION AND CONCLUSION

From the community interactions, we see differences in how constituent groups are centered in each department. While faculty are central for both, PSU strongly centers graduate students whereas LCU primarily centers undergraduates with graduate students slightly more peripheral to the community. The shared practice of each department is influenced by these interactions, but also serves to reinforce the centering of the different groups. Both departments are explicitly interested in the acculturation of new members (i.e., students) into both the local community of practice and the broader community of physics outside of their institutions. At PSU, efforts in this regard are led by individual faculty and predominantly focused on graduate students. In contrast, LCU explicitly engages both undergraduates and graduate students and many of these efforts are departmental in nature (e.g., the use of studio classrooms and departmental funding for conferences). From the shared practice, we see evidence of fundamental shared values: faculty autonomy for PSU and pastoral care[15] for LCU.

The importance of faculty autonomy at PSU is demonstrated by practices that center research preparation for graduate students, place decisions about teaching and mentoring solely in the hands of individual faculty, and by the physical segregation of faculty and graduate students by research area. In contrast, LCU's commitment to pastoral care means a shared practice that is more undergraduate focused, places more emphasis on joint work in faculty interactions, and a use of physical space that encourages interaction between different constituencies.

While these departments represent a contrast with each other, there are other models for departmental communities of practice. In addition, we are not making claims about how members of each community feel about the culture in these departments. Instead, we have shown how shared practice within a department affects and is affected by interactions and that these together illuminate foundational values within a community of practice.

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