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Leveraging Hispanic-serving institutions within physics education research

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Hispanic serving institutions (HSIs) are an increasingly large set of higher education institutions in the United States. From 2010-2020 the number of HSIs increased from 311 to 569. Within the physics education research (PER) community, research perspectives from HSIs have provided critical insights into how to support racially and ethnically diverse students. Within the last decade, research from HSIs made up approximately 20% of publications from US higher education institutions in common PER journals. These publications do not always fully name and leverage their HSI context, though the work done at HSIs still more consistently centers students' identities as compared to research from non-HSIs. As our research community looks forward, elevating and appropriately valuing research at HSIs will be critical to build a more robust understanding of physics education in multiple institutional contexts.

I. INTRODUCTION

Educators at high Hispanic enrolling institutions have been organizing for their students long before there was a formal definition of a Hispanic-serving institution (HSI). The Hispanic Association of Colleges and Universities (HACU), founded in 1986, played a large role advocating for federal recognition of HSIs [1]. This recognition came from Congress in 1992 via an amendment to the Higher Education Act (HEA) Title III-A, which established the Developing Hispanic-Serving Institutions Program [2]. The program was later moved to its own title (HEA Title V) in 1998 [2]. The HEA defines HSIs as institutions of higher education that enroll of at least 25% Hispanic students and at least 50% students who are eligible for need-based financial aid [3].

In the last three decades, the number of Hispanic-serving institutions (HSIs) in the United States has tripled, from 189 federally recognized HSIs in 1994 to 569 HSIs in 2020 [4, 5]. The growing number of HSIs is reflective of the growing Hispanic and Latino population in the United States [6]. Hispanic-Serving Institutions are the most numerous Minority-Serving Institutions (MSIs), enrolling two thirds of Hispanic and Latino students in the United States [7] and more Black and Native American students than Historically Black Colleges and Universities (HBCUs) and Tribal Colleges and Universities (TCUs) [8].

As noted by Kanim and Cid in "Demographics of physics education research," the physics education research (PER) community's body of research disproportionately studies whiter and wealthier students than the general population of students learning physics in the United States [9]. Research done in the contexts of HSIs have the potential to instead center racially and economically minoritized communities [8]. The landscape of HSIs is not a monolith [10], but includes many institutional contexts to learn in. Additionally, the extent that HSIs center and serve their students can vary, especially with the large number of newly designated HSIs that are just reaching enrollment thresholds. Garcia et al. emphasize the need to *serve* students, rather than enroll them, and there is varying institutional uptake among HSIs [8].

Our goal is to consider the role of HSIs within PER, in the same spirit (and inspired by) Kanim and Cid's work [9]. We explore:

1. What fraction of PER literature has been produced at HSIs?
2. How do demographics at high-publishing HSIs compare to the demographics of other high-publishing institutions in PER?
3. To what extent do publications from authors at HSIs acknowledge and take up their positionality at an HSI?

II. METHODS

A. AUTHORS' POSITIONALITY

Both authors are currently working at the National Science Foundation (NSF) with the Hispanic-Serving Institutions Program. In this context, we have been steeped in

thinking about and interacting with HSIs, though the opinions, findings, conclusions and recommendations expressed here are ours and do not necessarily reflect the views of the NSF. The first author has worked at an HSI and will resume teaching and research at an HSI. Neither author is Hispanic or Latina, and the first author was a Pell Grant recipient.

B. PUBLICATION CONTEXT AND ANALYSES

We collected all papers published during the years 2010-2021 from two journals: *Physical Review Physics Education Research* (PRPER) and the *Physics Education Research Conference Proceedings* (PERC Proceedings). From these papers, we catalogued all authors and their listed affiliations at the time of publication. Authors' affiliated institutions were connected to the Department of Education's 2021 eligibility matrix [5] to identify federally recognized HSIs. Because the HSI designation only applies to higher education institutions in the United States, all authors' institutions were also coded by country and type of institution (higher education, K12, nonprofit, etc) to better understand comparable subsets of publishing institutions.

Within the subset of PER published higher education institutions in the United States, we connected to data from the Integrated Postsecondary Education Data System (IPEDS) [11] to compare students' demographics (race/ethnicity and Pell Grant status) across the highest-publishing institutions (both among HSIs and generally).

To better understand the role of HSIs in literature from HSI authors, we selected a subset of the publications from HSIs (all papers published in PRPER, not including PERC papers) to evaluate more closely. Within each PRPER paper, we evaluated whether the data in the study came from an HSI, and if so, whether the paper mentioned the HSI context. In cases where the paper used data from multiple institutions, we classified the study as still using data from an HSI if there were five or fewer institutions and at least one of them was an HSI. In cases where researchers were using large data sets (more than 5 institutions, often nationally collected data sets), we did not classify the data as being HSI focused, even if there were HSIs included.

Additionally, we used MAXQDA to do counts on keywords related to race and other equity terms within all the PRPER papers, HSI or otherwise. We used these counts as a proxy for attention to race, ethnicity, and identity in the work.

III. RESULTS

A. PUBLISHING INSTITUTIONS

During the years 2010-2021, there were 812 PRPER papers and 1098 PERC Proceedings papers. Table I shows the number of papers associated with each country; if at least one author has an affiliation with a country's institution, the paper is classified as from that country. Therefore, papers are counted multiple times in the table if they have authors with affiliations from multiple countries.

TABLE I. Number and percentage of papers affiliated with countries' institutions in PRPER and PERC Proceedings. Papers with multiple country affiliations are multiply counted.

Country	PRPER	PERC	% of PRPER	% of PERC
USA	609	1015	75.0%	92.4%
Canada	30	22	3.7%	2.0%
Germany	28	14	3.4%	1.3%
China	24	3	3.0%	0.3%
Norway	21	9	2.6%	0.8%
Israel	20	11	2.5%	1.0%
Croatia	20		2.5%	0.0%
Italy	19	2	2.3%	0.2%
Belgium	16	1	2.0%	0.1%
Scotland	14	14	1.7%	1.3%
Ireland	14	9	1.7%	0.8%
Sweden	14	5	1.7%	0.5%
Finland	14	3	1.7%	0.3%
Taiwan	13	4	1.6%	0.4%
Spain	12	3	1.5%	0.3%
England	12	1	1.5%	0.1%
Australia	11		1.4%	0.0%
Mexico	9	26	1.1%	2.4%
Austria	9	3	1.1%	0.3%
Chile	8	8	1.0%	0.7%
South Africa	8	7	1.0%	0.6%
Japan	8	4	1.0%	0.4%
Netherlands	7		0.9%	0.0%
Turkey	7		0.9%	0.0%
Slovenia	6	2	0.7%	0.2%
Bosnia and Herzegovina	6		0.7%	0.0%
New Zealand	6		0.7%	0.0%
India	5		0.6%	0.0%
Brazil	4	2	0.5%	0.2%
Switzerland	4	2	0.5%	0.2%
Thailand	4	1	0.5%	0.1%
France	4		0.5%	0.0%
Denmark	3	1	0.4%	0.1%
Argentina	2		0.2%	0.0%
Portugal	2		0.2%	0.0%
United Arab Emirates	1	1	0.1%	0.1%
Bahrain	1		0.1%	0.0%
Ethiopia	1		0.1%	0.0%
Greece	1		0.1%	0.0%
South Korea	1		0.1%	0.0%
Uruguay	1		0.1%	0.0%
Vietnam		4	0.0%	0.4%
Oman		1	0.0%	0.1%
Panama		1	0.0%	0.1%
Distinct Total	812	1098		

TABLE II. Number of papers with authors affiliated to an HSI and number of published HSIs in each journal. The table also shows the percentage of HSI papers within the subset of papers from US higher education institutions, and within all papers in each journal.

Journal	# of papers from HSIs	# of published HSIs	% of US Higher Ed.	% of All
PRPER	127	30	20.1%	15.6%
PERC	223	24	22.1%	20.3%

Among the 609 of PRPER papers from the United States (75% of all PRPER papers), 607 of them had at least one affiliated US institution of higher education. Likewise, 92% of PERC Proceedings papers had an affiliated US institution, and 1010 of those 1015 were affiliated to a US higher education institution. These rates are comparable to the global set of PRPER and PERC Proceedings papers: 1904 of 1910 papers (all PRPER and PERC) include at least one higher education institutional affiliation. Further, among papers from US higher education institutions, 127 PRPER papers and 223 PERC Proceedings papers came from HSIs, representing 30 and 24 HSIs respectively. This data is represented in Table II. These papers from HSIs represent approximately 20% of literature from US HE institutions in our sample.

B. DEMOGRAPHICS OF HIGH PUBLISHING US HIGHER EDUCATION INSTITUTIONS

Within the set of United States higher education papers, the institutions with the highest number of publications are shown in Table III. Among the 20 highest publishing institutions in PER, 6 of them are HSIs. For each institution, the percentage of Hispanic and Latino enrollment and the percentage of Pell Grant recipients are also given. Pell Grants are awarded to undergraduates with exceptional financial need but are not the only need-based financial aid that qualify an institution for HSI designation. For comparison, the same information is given for the ten highest publishing HSIs in Table IV.

C. HSI CONTEXT IN PRPER PAPERS

There were 127 PRPER papers with HSI affiliated authors, and 83 of them had HSI affiliated researchers as the first author. Among the 127 papers, 37% of them (47 papers) primarily used data from an HSI. Within those 47 papers, 21 acknowledged their HSI status.

Within the PRPER papers, Table V shows the average number of times that specific keywords were used, within the subset of papers from HSIs and across full set of PRPER papers. Over all the keywords, the frequency of use within HSI papers was higher than the average use across all PRPER papers. Additionally, a larger percentage of HSI papers used each keyword at least once, compared to the percentage of all papers to use the keywords.

TABLE III. Number of publications by journal for US Higher Education institutions with 30 or more total publications. For each institution, the percentage of Hispanic or Latino students (Hisp %) and Pell Grant recipients (Pell %) enrolled are also given.

HSI	Institution	# of PRPER papers	# of PERC papers	Total # papers	Hisp %	Pell %
	University of Colorado Boulder	90	157	248	12.7%	16%
	Michigan State University	47	70	120	5.2%	22%
	University of Pittsburgh-Pittsburgh Campus	46	73	119	5%	15%
	Kansas State University	32	58	90	7.4%	23%
Y	Florida International University	39	50	89	65.1%	48%
	Ohio State University-Main Campus	44	29	73	4.7%	21%
	University of Maryland-College Park	35	38	73	9.2%	18%
	University of Washington-Seattle Campus	22	42	64	8.9%	21%
	Seattle Pacific University	21	40	61	14.2%	30%
	University of Maine	28	32	60	4.1%	29%
	Western Michigan University	20	32	53	7.1%	32%
Y	University of Central Florida	12	38	50	27.5%	38%
	Oregon State University	16	31	47	10.8%	26%
	Rochester Institute of Technology	14	31	45	8.1%	29%
Y	California State University-Fullerton	12	30	42	46.1%	49%
	University of Illinois at Urbana-Champaign	24	17	41	12.9%	23%
Y	Texas State University	6	34	40	39.6%	37%
	Cornell University	15	18	33	13.8%	17%
Y	California State Polytechnic University-Pomona	12	19	31	47.5%	48%
Y	California State University-Chico	8	22	30	35%	45%
Distinct Total		607	1010	1617		
Average (non-HSIs)					10.5 ± 0.4%	26.2 ± 0.7%
Average (HSIs)					42.7 ± 2.8%	42.3 ± 1.9%

IV. DISCUSSION AND CONCLUSIONS

Within the landscape of physics education research, Hispanic-serving institutions have played and will continue to play a critical role in diversifying our community’s research contexts. Among the top 20 PER publishing institutions in the United States, there are multiple high-publishing HSIs. Extrapolating from our sample, approximately 20% of PER literature coming from the US higher education system includes at least one author from an HSI. This analysis has the potential to miss work from HSIs by authors who are no longer affiliated with their HSI and no longer have any co-authors at their HSI, though we expect this to be a small fraction of papers. It should also be noted that beyond the context of the United States, there is significant research being done for Hispanic and Latino students. For example, Tecnológico de Monterrey in Mexico has published comparably as many papers as high-publishing institutions in Table III. This paper’s analysis focuses primarily on the context of United States higher education institutions in order to situate HSIs, not to discount work being done outside the US.

Although a large portion of published papers from the US do include authors from HSIs, and 65% of them including a

first author, less than 40% of the publications used data from their home institution or another HSI. Alternatively, they often used large public data sets or data from a larger collaborating institution. Considering the oversampling of these larger institutions within PER, there is missed value for our community in not centering HSI contexts in PER work. Because HSIs have been historically and are currently underfunded [12], and because many of the high-publishing HSIs in PER are primarily undergraduate institutions, it is possible that this is in part because some researchers at HSIs do not have the same research support, resources, and time to collect and process data as their colleagues at wealthier institutions. Therefore, these collaborations between institutions provide an opportunity to facilitate sharing of resources in order to elevate work being done at HSIs. Even among studies that used data from an HSI, less than half of the papers acknowledged their HSI status or context. HSI designations evolve, so it is possible that some publications were written before the institutions were HSIs, but there are still a large number of current papers from HSIs that are not fully leveraging their context as an HSI. There is need for the PER community to more holistically consider students in the United States, and HSIs are uniquely positioned to expand our collective exper-

TABLE IV. Number of publications by journal for HSIs with 10 more total publications. For each institution, the percentage of Hispanic or Latino students (Hisp %) and Pell Grant recipients (Pell %) enrolled are also given.

Institution	# of PRPER papers	# of PERC papers	Total # papers	Hisp %	Pell %
Florida International University	39	50	89	65.1%	48%
University of Central Florida	12	38	50	27.5%	38%
California State University-Fullerton	12	30	42	46.1%	49%
Texas State University	6	34	40	39.6%	37%
California State Polytechnic University-Pomona	12	19	31	47.5%	48%
California State University-Chico	8	22	30	35%	45%
California State University-San Marcos	6	10	16	48.3%	47%
San Diego State University	4	11	15	31.1%	33%
University of California-Santa Barbara	4	11	15	25.1%	36%
San José State University	4	6	10	29.2%	41%
Distinct Total	127	223	350		

TABLE V. Average frequency that specified keywords are used per paper, within the set of PRPER papers from HSIs (N=127) and non-HSI PRPER papers (N=685); percentage of papers within each subset that use specified keywords at least once. *Some keyword categories include variations: Hispanic includes *Hispanic, Latino, Latina, Latinx, Latinas, Latinos*; Black includes *Black, African American*; POC includes *BIPOC, POC, of color*; equity includes *equity, equitable, equitably*; identity includes *identity, identities*; women includes *women, woman, girl, female*; LGBT includes *LGBT, LGBTQ, LGBTQA, LGBTQIA, LGTBs, lgbtphysicists*.

Keywords*	HSI freq	non-HSI freq	% of HSI papers	% of non-HSI papers
Race	1.45	0.78	26.8%	16.5%
Ethnicity	1.19	0.46	29.1%	13.4%
Hispanic	2.09	0.64	37.8%	14.9%
Black	1.92	1.08	44.9%	26.9%
Asian	0.83	0.42	25.2%	12.6%
Native	0.47	0.29	21.3%	17.4%
POC	1.05	0.39	16.5%	8.2%
equity	3.46	0.69	31.5%	16.4%
identity	7.47	4.05	38.6%	26.7%
gender	9.58	9.05	55.9%	40.6%
women	16.39	12.40	59.8%	45.1%
LGBT	0.09	0.03	3.1%	1.9%
disability	2.39	0.08	10.2%	4.8%

tise. By definition, HSIs have higher representation of Hispanic and Latino students, and also enroll large numbers of Black, Indigenous, and Asian students. Of the 33 PER publishing HSIs, over half are also Asian American and Native American Pacific Islander-serving institutions (AANAPISIs). Additionally, HSIs enroll high numbers of low-income students, including Pell Grant recipients.

Whether this context has been historically valued and thus named explicitly, the work done at HSIs in the last decade has still outpaced non-HSIs in centering students' identities. Publications from HSIs more frequently discuss race, ethnicity, gender, and other characteristics of identity. The call to action from Kanim and Cid [9] pushes the PER community to consider the contexts of our research and the spaces that we are not representing. Research at HSIs has the potential to provide insights into racial and financial inequities in higher education that research in many other contexts cannot. Members of our community have done work to collaboratively interrogate and articulate the role of HSIs in PER [13]; leveraging and building from that work is crucial. A growing number of predominantly white institutions are emerging HSIs, and are beginning to grapple with what it means to serve their students. Likewise, our community has acknowledged the oversampling of white and wealthy students in our research. Hispanic-serving institutions provide much-needed context and expertise for the future of physics education.

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