SYNERGISTIC EFFECTS BETWEEN UNDERGRADUATE RESEARCH AND OTHER HIGH-IMPACT PRACTICES

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Abstract

Universities in the 21st Century engage students in multiple high-impact practices, which come at a significant cost to universities. Using a survey of 200 undergraduate researchers, we examine how high-impact practices combine to increase connection to universities, faculty, and programs during the course of a student's academic career. We find that there are substantial benefits perceived by students from participating in undergraduate research and that is compounded when participating in both undergraduate research and another high-impact practice.

Keywords: High-impact practices, student research, undergraduate research

Introduction

How do students who participate in undergraduate research engage with other high-impact practices (HIPs)? Universities in the 21st century engage students in multiple high-impact practices during the course of their university careers. Further, research has shown that participation in HIPs increases retention and career preparation (Kuh, 2008) so we often approach HIPs with the attitude that more are better as the compounding effects are valuable (Hatch 2012; Kuh, et al 2005; Kuh, Pace and Vesper 1997). However, implementing, sustaining, and assessing HIPs come at a cost to universities. These costs include the necessary infrastructure, staffing, and adjustments to faculty workloads. Thus, understanding the synergistic effects of multiple HIPs that students engage in throughout their entire undergraduate career may assist universities in targeting their efforts to the highest value high-impact practices. In other words, how does stacking HIPs lead to greater retention and career preparation?

The study of HIPs is not new, and many faculty and researchers have examined the impacts of HIPs in various settings and with various populations (e.g. Kilgo, Sheets & Pascarella, 2015). Given our current roles in higher education, we were interested in the story of our student researcher, but we realized that our undergraduate researchers also participate in other high-impact practices (as defined by Kuh 2008). Therefore, we should look more broadly at how these experiences combine to connect students to the university and prepare them for their careers. We posit that benefits of undergrad research do not stem just from a student's participation in undergraduate research, but from the ways that research experience interacts/stacks with other high-impact experiences which each student participate in during their undergraduate careers. Research has addressed the stacking of student research with international and service-learning experiences (Banks & Guiterrez, 2017); however, we expand that study by looking at additional HIPs. Using a survey of 200 undergraduate researchers, we were able to evaluate their experiences holistically by examining their participation in multiple high-impact practices - rather than in a vacuum - to understand how these high-impact practices stack to influence the student researcher's academic and career success. This is critical for universities to ensure maximum impact on retention, progression, and graduation with limited resources.

Generally, students who participate in undergraduate research increase their subject matter knowledge and their ability to conduct research (Russell, Hancock & McCullough, 2007). These students are more likely to increase their understanding of disciplinary work, gain confidence and increase awareness of graduate school options and experiences (Russell, Hancock & McCullough, 2007). Furthermore, they experience personal and professional gains such as learning to think like a researcher, obtaining career-ready skills, confirming their career plans, and becoming more prepared for graduate school (Seymour et al., 2004). Students who participated in collaborative undergraduate research with faculty early in their academic careers reported significant gains in the ability to think analytically and logically; put ideas together; and learn on their own. These gains were greater than those reported by students who did not participate in collaborative research with a faculty member (Ishiyama, 2002). Students who participated in undergraduate research were likely to have higher GPAs (even when controlling for the

previous GPA, parental college attendance, and class standing; Sell, Naginey & Stanton, 2018). Additionally, there are longer-term indicators of student success (e.g., graduation rate or national fellowship awards) associated with undergraduate research participation (Craney et al., 2011).

Timing of participation is also critical to understanding the impact of undergraduate research on students. The general wisdom is that participation earlier in a student's career has a lasting impact on retention, graduation rates, and student development (Russell, Hancock & McCullough, 2007). Specific research illustrates that a first year research experience has an immediate effect on second year academic performance as well as delayed effects on graduate school admission testing (Vincent-Ruz, Grabowski & Schunn, 2018).

Research experiences increase the retention of students at greater risk for college attrition (students with low GPAs and underrepresented minorities; Gregerman et al., 1998; Shen et al., 2018; Chan, Bhattacharyya & Meisel, 2018). Moreover, early participation in collaborative research was particularly beneficial for first-generation college students in terms of retention and graduation (Ishiyama, 2002). Undergraduate researchers from underrepresented groups reported higher learning gains than comparison students (Lopatto, 2007). The positive effects of undergraduate research experiences on retention and graduation rate tended to be stronger for Hispanic/Latino students than their white counterparts (Russell, Hancock, & McCullough, 2007). Early participation in undergraduate research opportunities also increased retention of African American students (Nagda et al., 1998; Gregerman et al., 1998).

Students who participated in student research were more likely to pursue graduate and professional education, and maintain faculty contact upon graduation (Hathaway, Nagda, & Gregerman, 2002). Predominantly white science and engineering majors from research universities who participated in undergraduate research report increased attainment of graduate degrees (Bauer & Bennett, 2003). Male and female students reported similar levels of benefits from undergraduate research and similar patterns of career plans (Bauer & Bennett, 2003). This pattern continues in Lapatto's (2004) study, as students from underrepresented ethnic groups did not significantly differ from their white

counterparts in reported levels of benefits or plans to continue with postgraduate education.

Method

Our survey regarding students' participation in high-impact practices was distributed at our university for six weeks in Spring 2019. This past academic year, our comprehensive university offered 90 bachelor's degrees and a variety of graduate programs. We also offer a number of micro-credentials and graduate certificate programs. Total enrollment at the university currently exceeds 15,500 students, including just over 12,000 undergraduate students. Many of our students are non-traditional, part-time, and commuters. The university places great emphasis on engaging students in experiential learning (especially undergraduate research) and faculty will tell you that undergraduate research is one of the defining characteristics of our university. We recently planned and launched a university-wide institute for student research and creative activity, and our celebration of student research highlights the work of over 400 students annually. With this in mind, our study of student researchers was undertaken in order to examine and make suggestions regarding how high-impact practices should be implemented on our campus to create the most impactful student' experiences.

Participants

We developed an original survey to gather information about participation in HIPs and distributed it on our campus for six weeks. Distribution included direct emails to students as well as postings on university social media accounts. We looked at general lists as well as specific subgroups of students to ensure large enough samples in each category and tapped into email lists from various offices on campus. Students were encouraged to participate in the Institutional Review Board approved survey by offering the opportunity to be entered in a drawing for an Apple Watch or two $100 gift cards. Students were required to log in with their usernames and passwords to participate—this provided their university identification to connect with Institutional Research data in our analysis. We had 1427 respondents to our survey of which 200 conducted student research.

Our 200 student researcher respondents, included 133 (67%) females and 53 (27%) males (14 unidentified); 155 (78%) white students, 4 (2%) students who identified

as Asian, 9 (5%) who identified as Black or African American, 11 (6%) who identified as Hispanic or Latino; 2 (1%) who identified as two or more races and 13 unidentified.[1] Looking at class standing of our student researchers; 19 of the respondents were freshmen, 22 were sophomores, 38 were juniors, and 108 were seniors. Of our participants, 61 (30.5%) were Pell eligible and 27 were transfer students. When asked what type of project students participated in, 28% indicated they had collaborated with a faculty mentor on a project; 39.4% said they worked on a faculty member's research project, and 32.6% indicated they had worked on an independent research project with faculty supervision. This gives us a wide spectrum of students involved in research on our campus. Respondents were asked if they had participated in 8 different high-impact practices: undergraduate research, civic engagement (defined broadly and then examined in depth), internships (paid/unpaid, credit/non-credit), study abroad, first year programs (including learning communities, introductory sections to specific programs, and student support programs), capstone projects, living learning communities (as part of the dorm assignments), and writing-intensive general education classes. While these do not perfectly align with Kuh's (2008) high-impact practices and the recent additions of e-portfolios – these are the high-impact practices on our campus.

Results

As noted, participants indicated which of these high-impact practices (if any) they had participated in and answered a battery of questions about those experiences. At the end of the survey, all participants were also asked to rate on a scale of 1-5 (one being lowest and five being highest) their agreement with statements about how well they adjusted to college (1), connected with the university (2), felt career (3) and graduate school (4) ready, built connections with faculty (5) and their major (6), and whether they planned to complete their education at our university (7) (for more information about the survey see Reilly and Langley 2021). Table 1 provides results from crosstabs indicating respondents who agreed and strongly agreed with these statements.

[1] This is fairly representative of our student body (60% female; 6% Black or African American; 2% Asian; 81% white; 4% Hispanic or Latino; 28% who are Pell eligible) with a slight over representation of female students.

Table 1: Cross-tabulations

	Adjusted (1)	Connected (2)	Career (3)	Grad School (4)	Faculty (5)	Major (6)	Complete (7)
Student Research (n=200)	94%	79%	75%	64%	80%	84%	95%
Student Research and Civic Engagement (n=127)	80%	80%	75%	65%	78%	84%	95%
Student Research and Internships (n=79)	98%	79%	83%	74%	86%	87%	86%
Student Research and Study Abroad (n=41)	94%	90%	84%	73%	90%	90%	97%
Student Research and First year Programs (n=103)	93%	86%	75%	64%	85%	86%	95%
Student Research and Capstones (n=49)	97%	83%	86%	75%	84%	87%	98%
Student Research and Living Learning Community (n=26)	100%	85%	76%	62%	81%	90%	100%
Student Research and Writing Intensive General Ed (n=66)	93%	88%	75%	73%	84%	84%	98%
Did not participate in student research (n=1247)	84%	52%	60%	45%	53%	69%	92%

Students overwhelmingly felt that participation in these high-impact practices helped them adjust to college and positively influenced their attitudes about degree completion. Students who did not participate in student research were less positive across all factors. However, students who participated in student research felt strongly connected to the university, their majors and faculty, and they felt prepared for careers and graduate school. The largest differences between those who did undergraduate research and those who did not appeared in three categories: connection to the university, graduate school

readiness, and connection to faculty; this reinforces the literature on the benefits of undergraduate research.

However, when comparing the perceptions of students who only participated in student research versus those that participated in multiple HIPs there were few significant differences. In other words, the participation of students in multiple high-impact practices did not appear to increase student's feelings of connection to the university or preparation for their careers. While the evidence provided here does not address each of the other HIPs alone, there are clear gains among students who participated in both student research and internships and student research and study abroad – illustrating the increased value those two high-impact practices provide when they are both done by the same student (see Table 1).

When combining (or stacking) undergraduate research with other HIPs, it is clear that there is a value to participating in undergraduate research either alone or in conjunction with other high-impact practices. Thus, it is important to invest in these practices. Student research is not an inexpensive endeavor and so the return on investment needs to be clear. This evidence suggests that student research is worth the investment and that adding additional HIPs does increase student feeling of connection and participation; however marginally.

It is possible that participation in multiple HIPs increases with progression toward degree, and thus, so do feelings of connection and preparation, but the number of participants in the survey for each class was too low to tease out those potential differences. We plan to follow up with focus groups separated by year (e.g., freshman, sophomore) in order to explore the survey answers in more detail. However, our results point to the importance of other universities conducting similar surveys to assess the impact of their high-impact practices before assuming that "more is better." Anecdotal evidence from our survey suggests that respondents who did not participate in high-impact practices overwhelmingly indicated that the reason was that they were unaware of the opportunities rather than lack of time, interest, or other obligations. However, another issue can be that students are unfamiliar with what high-impact practices are (such as

student research), and thus, even if they see opportunities are unlikely to apply or investigate those opportunities (Mathis et al. 2015).

Table 2: Regression Analyses of Student Research Impacts

	Adjusted (1)	Connected (2)	Career (3)	Grad School (4)	Faculty (5)	Major (6)	Complete (7)
Student Research	.294**	.692**	.388**	.483**	.695**	.447**	.132*
Female	.049	.133	-.040	.072	-.038	.019	.170**
Black	-.067	-.107	-.208	-.469*	-.219	-.068	-.105
Latino	.051	-.211	.111	-.116	-.053	-.133	.146
White	.095	-.139	.068	-.050	-.120	.098	.129
Pell	-.061	-.133	-.006	-.031	-.075	-.014	.033
R2		.037	.027	.033	.054	.023	.022

**p>.05; **p>.01.*

When looking at the relationships in regression analysis, we found that with a few exceptions, students' perceptions of the impact of these HIPS on their feelings of connection and preparation did not vary based on race, gender, or income status. Participation in student research was a significant predictor of how students felt they adjusted to college life, how connected they felt to the university and faculty, and how well prepared they felt for their careers and graduate school ($p<0.05$). Unsurprisingly, the combination of participation in internships and student research was also significant in helping students feel better prepared for career and graduate school ($p<0.05$). There were two findings based on race and gender that were significant: participation in student research was significant in helping Black students feel more prepared for graduate school ($p<0.05$) and in improving female students' confidence in their ability to complete their degrees. Please note that our sample of minority students is quite small and while significant should be downplayed. Similar to the findings of Bauer and Bennett (2003) this suggests that the common perception that participation in HIPs by students that are underrepresented in higher education will increase their comfort and success is not supported by the analytical evidence.

Discussion

The data collected from this survey and the subsequent analysis demonstrates that student participation in high-impact practices does result in students feeling more connected and prepared, although there are few differences based on race, gender, or income. Surprisingly, participation in student research along with additional HIPs does not substantially result in an increase in those feelings. This suggests that our focus should be on ensuring that every student engages in at least one HIP (and of course from our perspective undergraduate research), rather than trying to engage a fewer number of students into multiple HIPs. Participation in high-impact practices later in their academic career (such as student research and internships) seemingly increases feelings of career and graduate school readiness more so than first-year experiences. This does seemingly conflict with the existing research that suggests that more is better. However, it is the nuances that we seek to add to the research looking at which high impact practices connect together to serve our students and how to strategically invest in these practices and engaging more students in at least one rather than engaging a small number in several.

The next steps of our analysis will look at institutional data about retention, progression and graduation rates for students participating in multiple HIPs. Further, we are interested in looking at the impact of GPA on participation in multiple HIPs –well-prepared students may engage in multiple HIPs but gain less from each additional experience than students who are less prepared but participate in only one HIP. We would also like to add a focus group to illustrate how these HIPs build on one another to create nuance to degree progression and where these types of interventions can be most beneficial.

What can be learned by readers?

We often focus on the role that undergraduate research has on graduate school or career preparedness, but we need to look beyond the one experience. Students do not conduct undergraduate research in a vacuum. As we move through the 21st century, we must understand that college experiences have changed. Students have lives outside of the lab or research experience (ex. other HIPS and student life) and we need to account for that variation and learn how to optimize student experiences and learning beyond the

classroom. Determining how to pair HIPs with or beyond undergraduate research to understand the optimal impact on students is an important contribution to higher education. Further, the value of higher education is being questioned frequently requiring educators and administrators alike to focus on what works and what does not to increase retention, progression, and graduation.

While many institutions may want to conduct a similar study university-wide, our results are particularly important to institutions that are having conversations about reducing programs with decreasing revenue streams. These programs work in conjunction. There is no silver bullet that allows us to investigate student research alone – rather we need to look holistically at the student's experience in other high-impact practices to see what provides the most value.

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