A Student-Centered, Expanded Approach to the Undergraduate Research Experience

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ABSTRACT Student involvement in faculty research is on the rise because it serves at least three sets of interests: (1) students' desire to build their résumés and develop close relationships with faculty members; (2) faculty members' hope of getting research support from bright, attentive assistants; and (3) universities' wish to publicize these opportunities to incoming student and faculty cohorts. At times, faculty members may come to see their undergraduate researchers as a source of inexpensive but high-quality labor, forgetting that they are students who are at the university to learn critical skills. In this article, I make the case for a student-centered approach to the undergraduate research experience (URE), which combines a traditional apprenticeship with a curriculum in the "what," "why," and "how" of research and expands the program over multiple semesters, supporting a team of student apprentices. I argue that this approach meets more of students' goals while also supporting faculty and university interests. I describe the multi-semester URE that I have developed and provide tools to faculty members who want to adapt this program to their home institution.

As faculty members, we sense the pressure that undergraduate students feel to do research with us. Some students want to add a line to their résumés; others want to gain skills for landing a job after graduation or simply to explore their interests by learning more about ours. The undergraduate research experience (URE) is known to support student success in all these many ways (Ishiyama 2002; Ishiyama and Breuning 2003; Palmer et al. 2008), to boost faculty productivity (Morales, Grineski, and Collins 2018), and to serve the university's bottom line (Morrison et al. 2019). Yet the traditional URE model—a one-semester or one-term apprenticeship that targets one or two exceptional students—fails to meet many student goals. It also restricts access, potentially excluding students from marginalized communities—those who stand to gain the most from the experience (Awong-Taylor et al. 2016; O'Donnell et al. 2015; Russell, Hancock, and McCullough 2007).

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In this article, I make the case for expanding the scope of the URE by combining a traditional apprenticeship with a curriculum in research methods and including a large team of undergraduate students over multiple semesters. This expanded program has the benefits of (1) increasing access, (2) offering more holistic training in research methods and professionalization, and (3) economizing on faculty time—with an added boost to research productivity. This ensures that the URE fulfills its goal of being a high-impact practice (HIP) for the university, providing "benefits to both students and the faculty while contributing to the scholarly goal of producing new knowledge" (Morrison et al. 2019, 3). After advocating for this expanded, student-centered URE, I describe the program that I have been running successfully for six years at a large research institution. My hope is to inspire faculty to develop similar programs at their home institution.

EXPANDING THE SCOPE OF TRADITIONAL URES

Undergraduate students have many reasons for seeking a research experience with faculty members: a desire for mentorship, an

interest in skill development, and simply wanting space to explore their own interests. Traditional UREs typically take the form of an apprenticeship, targeting one or two exceptional students who work alongside faculty members on a faculty-defined research project for a single summer or semester. However, expanding

senior thesis. Participants who wrote a senior thesis reported in the survey that the coursework component of the URE program was especially helpful in preparing them for this process, compared to only the apprenticeship.[1] In open-ended responses, one student explained that the coursework "allowed [them] to explore

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the URE into a student-centered program—by (1) adding a curricular component to the apprenticeship, (2) working with a team of students, (3) over multiple semesters—ensures that more student ambitions are fulfilled while also serving faculty and university interests.

Addition of Curriculum

Adding coursework in research methods to a traditional apprenticeship integrates key aspects of undergraduate methods training into the URE, resulting in better trained apprentices. This also meets the goal of teaching methods "by stealth" throughout the undergraduate curriculum (Andersen and Harsell 2005; Gunn 2017), helping students to develop key skills without triggering anxiety associated with standalone methods training (Adriaensen, Coremans, and Kerremans 2014; Slocum-Schaffer and Bohrer II 2021). As apprentices, students gain an understanding of the "why" of research—for example, the motivations of the principal investigator (PI) for developing a particular project—as well as the "how" of research—that is, the practical steps of building a specific dataset or conducting a particular empirical test (Becker 2020; Page 2015). Yet when a hands-on research apprenticeship is combined with coursework in research methods—teaching students about the research process more broadly and helping them to apply these steps to investigate an issue of interest to them—they deepen their understanding of both the "why" and the "how" (Bos and Schneider 2009).

After completing this multifaceted training, students gain the ability to write independent research papers, become more engaged in their other courses, and even gain confidence outside of the research process (Hunter, Laursen, and Seymour 2007). A survey of current and former participants in my research program supports these conclusions (see online appendix A2): all respondents (N = 33) reported that the coursework component of the program helped them to gain some (60%) or many (40%) skills that supported their success in other courses (Livny 2023). Moreover, each of 14 specific skills was reported to have been acquired by at least 75% of the survey respondents. Furthermore, when compared to similar non-participants (see online appendix A3), the students in my expanded URE program enrolled in significantly more advanced courses as undergraduates, achieved a significantly higher overall GPA, and were significantly more likely to write a

some research topics...before committing to writing a senior thesis." Another wrote that the opportunity to develop their own research project made them "want to continue research postgraduation," which highlights the way that the addition of a curriculum can support student achievement far beyond the classroom.

Multi-Semester Program

Along with the addition of a curriculum, expanding the URE program over multiple semesters has other advantages. In the coursework component, a multi-semester program allows the training in research methods to be layered: students begin with learning the basics of the research process (semester 1), before applying these skills to a question of their choosing—first on a small scale (semester 2) and, later, developing a more complex independent project (semester 3+). Nurturing students' curiosity about their own research interests requires more time than faculty members often recognize—especially among first-generation students and those from marginalized communities, who have been found to benefit the most from UREs that encompass multiple semesters (Hernandez et al. 2018). In the apprenticeship, working with the same group of students over multiple semesters also has advantages, allowing faculty members to identify and nurture students' leadership potential. Returning (i.e., "senior") apprentices become team captains—taking ownership over the training of incoming apprentices and fielding questions—all while developing their own skills in how best to communicate with the more-junior team members.

I have found evidence of the value of a multi-semester URE program in both the student-achievement data (see online appendix A3) and the survey of participants in my program (see online appendix A2). Compared to similar non-participants, as well as participants who spent less time in the program, those who completed at least two semesters in the program showed signs of achievement in all three metrics: they took more advanced courses as undergraduate students, achieved a higher GPA, and were more likely to complete a senior thesis.[2] In the survey, every respondent who wrote or is planning to write a thesis spent more than one semester in the program. Similarly, every graduate of the program who currently is involved in research postgraduation—as well as every current student who plans to pursue a research-oriented

career after graduation—spent multiple semesters in the program, as did every respondent who worked as a faculty research assistant after starting the program. In addition to these achievements, participants specifically cited in open-ended survey responses the significance of the leadership opportunities afforded to them in subsequent semesters of the program. One student explained that helping "junior [apprentices] learn the ropes over the first few weeks gave [them] valuable leadership experience." Indeed, 93.3% of respondents who spent multiple semesters in the program reported gaining key communication skills from working with more-junior team members.

Supporting a Larger Team

Because a multi-semester program supports the addition of peer mentorship, faculty PIs have the capacity to expand the traditional individual URE to take on a larger team of student apprentices. Although individual apprenticeships provide students substantial one-on-one support, they do not give them the opportunity to engage in peer mentorship and develop team-based communication skills. In the survey of current and former students in my URE program, written and verbal communication with both junior and senior team members were some of the key skills gained during the apprenticeship, and they often outperformed communication with peers. The benefits of a collaboration in research are well known and, in their open-ended survey responses, students recognized the importance of "working together…to solve a complicated…task that was affecting multiple [cases]" in their apprenticeship. Yet there also are benefits to collaboration that extend to the coursework component of the program. Open-ended responses revealed how students appreciate "hearing about everyone's [research] progress," especially when other team members speak openly about "roadblocks" they face. This helps everyone to put their own difficulties into proper perspective.

Traditional, individual UREs simply miss out on the best aspects of collaboration and team building. By restricting the URE to one student or a small group, traditional programs limit access to this valuable experience—and there is evidence that students from historically marginalized groups are less likely to be recruited to participate in smaller-scale programs (Awong-Taylor et al. 2016). In contrast, a lab-like research team expands access while also promoting diversity and inclusion (Nonnemacher and Sokhey 2022). During the past six years, I have found that I can support more students than I first believed possible. Initially, I assumed I could support only two or three new students every year, but my most recent cohort included more than 10 students. Moreover, a larger group supports diversity across multiple dimensions. As identified in a series of questions at the end of the survey, the majority of participants in my program are non-male; at least one third are members of a historically marginalized racial group, historically marginalized ethnic group, and/or the LGBTQ+ community; and one quarter are first-generation students.

Costs and Benefits to Faculty

Expanding the URE program to include more students over multiple semesters undoubtedly requires an increase in a faculty member's time commitment, although not as much as might be expected. With multiple cohorts and an explicit focus on collaboration, senior apprentices can train and mentor junior apprentices. This allows faculty members to spend less time on these tasks, plus training and mentorship by slightly "senior" peers also typically results in better-trained junior apprentices. Having had hands-on experience over multiple semesters, the senior students understand many research tasks even better than the PI. The act of training junior apprentices also boosts the confidence of senior apprentices. As a result, they require less direct supervision by faculty members while also providing more reliable and efficient research assistance.

The addition of a weekly or biweekly meeting to review the coursework component of the expanded program initially may seem like a net increase in a faculty member's time commitment; however, it has key benefits related to efficiency and productivity. As students develop a better understanding of the research process through the coursework, they become even better apprentices.[3] In my fully expanded URE program—with the added coursework component and inclusion of a team of apprentices over multiple semesters—I can support slightly more than 20 undergraduate students each semester who generate an enormous amount of high-quality, hand-coded data for my research projects. Moreover, I run this program while teaching the associated courses at overload, in addition to my regular teaching responsibilities. There likely are even more benefits to faculty members if the expanded URE program becomes part of a department's undergraduate curriculum and adopts a "hub-and-spoke" structure.[4]

A MULTI-SEMESTER UNDERGRADUATE RESEARCH CURRICULUM

My URE program combines a hands-on research apprenticeship with a four-semester research methods curriculum, and I encourage students to commit at least two semesters to the program. Ideally, they join the program at the beginning of their sophomore year to fully prepare them for a potential senior thesis project. This section describes each semester of the program, with a particular focus on the curriculum that is added to the more traditional apprenticeship. (See online appendix A1 for more details, including readings, assignments, and goals for each meeting.)

Semester 1: The "What," "Why," and "How" of Social Scientific Research

Following Becker's (2020) advice, the first semester begins with significant structure, clearly communicating my expectations and the motivation for the apprenticeship and the curriculum. The first meeting (unit 1) grounds the students in the "what" and "why" of the apprenticeship project. After briefly explaining my reasons for developing the project, I invite them to find their own way of connecting to it. We also discuss the "how" of the apprenticeship: we review the codebook(s) for their assigned project task(s) and I assign a pair of training exercises to complete during the first two weeks. This introduction to their apprenticeship is led by me, but I invite senior apprentices to join so they can quickly begin practicing their leadership skills.

The remaining meetings are less focused on the apprenticeship and more focused on research methods, although we may brainstorm solutions to common sticking points as the apprentices continue their training. Our second meeting (unit 2) concerns the power of data—both qualitative and quantitative—to generate

patterns that help to identify puzzles that we may want to research. I present a pair of patterns, generated from our research project, and encourage the students to name the puzzles they see. This highlights how different eyes are drawn to different questions—none of which is "right" or "wrong." In the next lesson (unit 3), they read a short literature review on a topic of their choosing and identify the questions that have been asked on that topic, how scholars have responded to one another, and how they have worked to resolve any disagreements. I also ask the students to think about the additional question(s) that they might raise. I seek to reinforce the idea that research involves collaboration among scholars with diverse perspectives and that they can contribute to ongoing debates.

Armed with an appreciation for how research questions emerge —whether inductively or deductively—we now consider the ways that data can help us to answer our questions. We begin with the basics of data (unit 4), defining terms such as "observation," "variable," and "levels of analysis." I then present the same data, aggregated at different levels, and we discuss uses for each dataset to appreciate how different questions require different types of data. This leads organically to the next lesson: a more theoretical discussion of data generation that focuses on conceptualization and measurement (unit 5). Together, we consider the different ways that the same latent variable can be defined and observed.

We build on these lessons when I invite students to engage with an existing dataset (unit 6). From a list of sources commonly used by political scientists, they select one dataset, describe it to the team, and identify at least one research question that could be addressed using these data. Their next exercise uses the data to assess a bivariate correlation of interest, using statistical software of their choice (unit 7). In class, I offer a brief tutorial in producing a scatterplot with a fitted line in R. I conclude the class by highlighting how, through this exercise, the students defined (and tested) their first hypothesis. Based on this experience, they write their final memo, which identifies two questions on a topic of their choosing that they would like to investigate in the future.

Semester 2: Applying Research Skills on a Small Scale

As in the first semester, we begin the second by reflecting on the apprenticeship (unit 1). To re-ground the students in the "why" of the project and reinforce the idea that research can evolve over time, I ask them what they have learned from the apprenticeship so far and to identify any new puzzles they have encountered. As we transition to the research methods curriculum in unit 2, they complete an at-home exercise to identify their research interests and translate them into a relatively narrow research project that is based on a question of the simplest form: Does x cause y? Next, I invite the students to explore what studies already exist on this question, again reinforcing the idea that research is a collaborative and iterative process (unit 3). By engaging with what has come before, they can identify the specific contribution that they are making, however minor.

Before designing a test of whether x is (at least) correlated with y, we spend a week developing their intuition for why such a relationship is likely to exist (unit 4). The students work to identify the logical steps connecting x and y, focusing on what the key actors want at each stage. With their theory more fully developed, the students are ready to design a test. As in the first semester, we begin with conceptualization and measurement by describing an ideal data-generation process (unit 5) before

searching for a ready-made dataset that can approximate it (unit 6). After identifying potential data sources, we discuss the practicalities of constructing a dataset, including the challenges of aggregation, merging, and recoding (unit 7). This leads to a basic test of their hypothesis: looking for a bivariate association between x and y (unit 8). In their final memo, the students combine all of these pieces: motivating their question as a contribution to an existing literature; describing their theory before presenting their test; and, finally, discussing their results—including a thoughtful consideration of why the test may not have supported their original hypothesis—all with an eye toward next steps.

Semester 3+: Developing an Independent Research Project

By their second year, the students have become senior apprentices. They have developed critical skills and, equally important, a healthy sense of confidence. I like to begin the year by having them appreciate that they are in the same position as the senior apprentices who helped to train them. I encourage them to step up to help answer questions raised by the new junior apprentices. I occasionally join these discussions, offering affirmation and additional information when necessary.

As in the apprenticeship, the second-year students come to class with key tools in place: they have a sense of what they are curious about and have practiced applying all the steps of the research process to one small question. With these tools in hand, they can develop a more complex, independent project. The project may become their senior thesis, may be linked to a course they are currently taking, or may be a project of personal interest. If their question relates to their apprentice work, I offer to develop a coauthored paper with them. However, I have found that students typically prefer to explore their own research interests rather than build on mine. To prepare them for any of these types of projects, we spend our first meeting (unit 1) reviewing the structure of social scientific research, clarifying how each step will be more complex than those taken in the previous semester.

Next, the students define their research question and I confirm that the project they are considering is feasible given their time, skills, and resources (unit 2). They then develop their theory, building on the existing literature about their chosen topic (unit 3). Using their theory, they define an appropriate test, considering how they would define and measure their variables (unit 4). Next, they begin to construct their datasets, relying on a combination of ready-made and bespoke data, whether collecting observable data or fielding an original survey in a convenience sample (unit 5). At the end of this semester, they use the preliminary data they collected and run an initial test of their theory (unit 6). We spend our final class meeting discussing these results, noting where each student could devote more time and thought (unit 7). They combine these different pieces in a first draft of their project, including a list of next steps, which may include adjusting their question or theory, expanding their data collection, or redesigning their test.

In the fourth semester of the program, students make these adjustments to and additional investments in their project. By the end of the semester, and aided by a series of checkpoints throughout the term (see online appendix A1.4), the students have produced a polished research paper motivated by a question of scientific significance and have presented a logical theory that is tested with novel data. Students who completed this fourth

semester by the end of their junior year are in an excellent position to tackle a senior thesis project.

CONCLUSION

In our desire to provide undergraduate students a hands-on research experience, faculty members often target one or two exceptional students and offer them a one-semester or one-summer apprenticeship. I advocate for broadening the scope of the typical URE with a multi-semester, team-based program that combines a traditional apprenticeship with a curriculum in research methods. This student-centered approach to the URE addresses many more of the reasons that undergraduate students seek out research experience, and it also has the benefit of providing higher-quality support for faculty research, thereby boosting faculty productivity. This approach increases student access while making a faculty member's time investment more efficient. All these benefits help the URE program fulfill its promise of being a HIP for students, faculty members, and universities.

The four-semester curriculum I have described in this article is available to faculty members interested in developing a similar program at their home institution (see online appendix A1). Although it originally was designed to train apprentices in comparative politics research, the curriculum has been successfully adapted by colleagues in American politics, international relations, and political theory, which indicates that it has broad relevance. The current model involves a single faculty-member PI running both the apprenticeship component and the coursework. However, the program has the potential to be scaled up as a key component in a department's undergraduate curriculum. A hub-and-spoke structure would task a single faculty member to cover the coursework in research methods and different faculty-member PIs to adopt subgroups of apprentices to work on various research projects. This model reduces the overall time commitment, allowing more faculty to take on teams of apprentices and further expand student access. Gains in efficiency and access should more than compensate for the fact that the "hub" faculty is not available to teach another traditional course.

For these reasons, I encourage departments to consider making a multi-semester, team-based research apprenticeship with embedded coursework part of their undergraduate curriculum. Institutions would be wise to invest in these types of URE programs. Whether administered by a single faculty-member PI or an entire department, a student-centered research program can succeed in a variety of institutions—from research universities to liberal arts and community colleges—in a variety of disciplines. I look forward to seeing how it evolves.

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DATA AVAILABILITY STATEMENT

Research documentation and data that support the findings of this study are openly available at the *PS: Political Science & Politics* Harvard Dataverse at https://doi.org/10.7910/DVN/DWLGEX.

SUPPLEMENTARY MATERIAL

To view supplementary material for this article, please visit http://doi.org/10.1017/S1049096523000379.

CONFLICTS OF INTEREST

The author declares that there are no ethical issues or conflicts of interest in this research. ▪

NOTES

1. Among the seven students who initially had not planned to write a thesis but eventually decided to, the importance of the coursework relative to the apprenticeship was especially starker: 66.7% stated that the coursework was very helpful in preparing them to write a thesis, compared to 57.1% who stated the same about the apprenticeship.
2. These statistics exclude students who participated in the program before multiple semesters were offered, as well as those who recently completed their first semester in the program and have not yet had the opportunity to participate in multiple semesters.
3. Indeed, more than 70% of current and former participants in my URE program responded in the survey that the coursework supported their success as apprentices.
4. The "hub-and-spoke" model is described in more detail in the conclusion. It tasks a single faculty member to cover the program's coursework in research methods, while different faculty-member PIs adopt subgroups of apprentices to work on various research projects.

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