PURM
Perspectives on Undergraduate Research & Mentoring

Engaged Learning and Transitioning to College: Student Reflections on A First-Year Seminar Mentored Course-Based Research Experience

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Introduction

Over the past two decades, there has been an increased focus on student engagement in higher education. Efforts related to student engagement have been framed both in terms of career and civic readiness to lead lives of meaning and purpose, and in light of a growing body of literature on how learning takes place (Bransford et al., 2000; Budwig & Alexander, 2020; Budwig & Jessen-Marshall, 2018). Student learning is enhanced when students experience deep learning that actively engages their curiosity and activates critical thinking, and this occurs especially when student learning is anchored in authentic contexts (Bransford et al., 2000; Budwig & Alexander, 2020). Students thrive on challenging academic content, supported through ongoing relationships which provide support and scaffold students' growing sense of agency and responsibility for their own learning (Felten & Lambert, 2020).

Although engaged learning practices are known to enhance student learning, we also know that few high school students have significant opportunities for inquiry-based learning and research. Early exposure to these skills and practices is critical to college success (Dudley-Marling & Michaels, 2012). In this paper we report on prior literature on engaged learning, the transition to college, and course-based undergraduate research experiences (CUREs) and what such work reveals about student development. We then describe a CURE embedded within a first-year seminar that the student co-authors of this article enrolled in during their first semester of college. The student reflections highlight the important role CUREs can play in students' academic identity development when carefully mentored. In addition to discussing how to enhance students' understanding of research, we discuss several transferable skills and practices that students in all fields of study carried forward with them as they continued their college journey. We also provide student perspectives on mentoring experiences, including a thorough discussion of what they find important about disseminating research in order to optimize the impact on student engagement and learning.

Prior Research Guiding the Organization of the CURE Embedded in a First-Year Seminar Experience

Engaged Learning

There is ample research highlighting the importance of engaged learning for student success. While often engagement has been interpreted to mean a "learn through doing" approach with students involved in classroom activities, a body of work has highlighted the critical importance of *purposeful engagement*. What is central to purposeful engagement is going beyond participation to include what

Astin (1984) has described in terms of both physical and psychological energy that students dedicate to their academic activities. As Kinzie and Kuh (2004) have noted, action and purpose are critical. Kuh (2008) has described a range of significant learning experiences that benefit student engagement and are connected to student success. Referring collectively to these as high impact practices (HIPs), these experiences include practices such as first-year seminars, learning communities, undergraduate research, internships, and capstone experiences. Drawing on data from The National Survey of Student Engagement (NSSE), an instrument used at more than 1500 higher education institutions, evidence suggests these high impact practices, along with other features such as academic challenge, experiences with faculty, opportunities to learn from peers, and supportive campus environments, collectively lead to educationally purposeful learning.

Over the last decade, as numerous colleges and universities sought to include HIPs into their curricular offerings, it became clear that while students were more actively involved in such learning experiences, too few students experienced purposeful engagement and sometimes ticked off boxes just to complete certain HIP requirements. In an attempt to ground purposeful learning in cross-disciplinary inquiry and integration of prior learning, the American Association of Colleges and Universities (AAC&U) developed the Liberal Education and America's Promise (LEAP) Challenge as part of its centennial celebration and advocated for the concept of signature work (Association of American Colleges and Universities [AAC&U], 2015; Schneider, 2021). As Schneider (2021, p. 163) explains:

> Signature work describes students' learning related to a problem or project over at least a semester and often longer. It may include work in and across thematically linked courses, research, practicums, community service, or other experiential learning. It will always include writing and reflection of multiple kinds. The key idea is that the student takes the lead, with faculty and mentors, in pursuing a significant question and in producing work that expresses the insights and learning gained from the inquiry.

A central goal of signature work has been to make sure all college students have the opportunity to carry out an extended and original piece of inquiry (AAC&U, 2015; Budwig & Jessen-Marshall, 2018). In addition to the classroom experience, the concept of signature work includes publicly sharing work and completing a project that has meaning for the student and society in a way that transcends the boundaries of an individual classroom. Critical to students' learning is the involvement in research or internships that provide students with opportunities to both integrate and apply what they learn to authentic problems for which there is no single answer and that contribute to larger issues of consequence. While many colleges and universities endorse this kind of work, early research suggests that not all students are equally prepared for engaging in this kind of inquiry and engaged learning (Budwig et al., 2018).

From the earliest stages of interest in inquiry-rich engaged learning there has been a recognition that campus leadership and professional development for faculty and staff would be required. Significant faculty development is needed to ensure that faculty driven HIPs are of high quality. Simultaneously, there has been a focus on the need to ensure that all students and not just the very best have the opportunity for purposeful and engaged learning while at college (Boyer, 1987; Ferren & Paris, 2015). Despite attempts for equitable opportunities, research has highlighted that there are systemic and institutional barriers to delivering on the promise of engaged learning experiences which prevent all students from experiencing purposeful learning (Finley & McNair, 2013; Schneider, 2021). Whether designing HIPs such as first-year seminars or undergraduate research or capstones, significant barriers have been identified (Longmire-Avital, 2018; Vandermaas-Peeler et al., 2018). Most recently, there have been increasing calls for the burden to shift from students finding opportunities towards holding institutions accountable in assuring all students are equitably

provided these opportunities. Student-ready institutions are ones at which faculty, staff, and administrators are not only responsible for but also provide high quality professional development that ensures faculty are prepared to deliver high impact practices that allow diverse populations of students to experience purposeful learning opportunities (Pendakur et al., 2020; Schneider, 2021).

Transitioning to College

Although students develop across the entire college experience, there is no doubt that the transition from high school to college is the most dramatic change for college-attending students (Schreiner, 2020). Transitioning to the academic ways and mores of college life, with the increased expectations for student autonomy and inquiry-based learning that requires students to synthesize and apply prior learning, is dramatically different than what many high school students have experienced. Conley (2008) examines these differences, arguing that current measures of college readiness, with emphasis on test scores, do not capture the essential skills and practices necessary for the engaged learning many will meet up with in college. He goes on to argue that "At the heart of college readiness is development of the cognitive and metacognitive capabilities of incoming students. These include analysis, interpretation, precision and accuracy, problem solving, and reasoning" (Conley, 2008, p.25).

Thriving in the transition to college has been tied to classroom experiences of the sort outlined above on engaged learning. First-year seminars are increasingly used to help students transition to college, and comprehensive reviews of prior research on the benefits of first-year seminars highlight the significant advantage to students who participate in these courses (Mayhew et al., 2016; Pascarella & Terenzini, 2005). It is precisely students' practice with the sort of features identified for engaged learning that can enhance first-year students' successful transition to college. These features include creating a sense of community, emphasizing the diversity of students' strengths, providing structured assignments set at appropriate levels of challenge, and providing iterative feedback and opportunities for students to improve (Louis & Schreiner, 2020; Nelson et al., 2020). Nelson et al. (2020) note that first-year seminars provide an important avenue for reaching all students and provide precisely the sort of support necessary for student flourishing and academic success in college.

Course-Based Undergraduate Research

Research experiences have been identified as high impact practices that can enhance student learning and ability to thrive in college. Nevertheless, given their reliance on apprentice-like pedagogies, it has been noted that they are difficult to scale and also that such experiences cater to a limited number of students who have the confidence to contact faculty or the personal networks to secure research experiences (Dolan, 2016; Quaye et al., 2020). Dolan (2016, p.3) defines course-based undergraduate research experiences (CUREs) as "learning experiences in which whole classes of students address a research question or problem with unknown outcomes or solutions that are of interest to external stakeholders." CUREs have been distinguished from other sorts of science laboratory learning experiences because students engage in a range of scientific practices such as reading literature, formulating a novel research question, finding results for which there is no one answer, and publicly presenting findings in a way that goes beyond the class (Dolan, 2016). Students need not just participate in practices that map what experts do, but it is particularly important that the output of such experiences is of value to external stakeholders and the student experience includes contributing to a body of knowledge related to the inquiry (Dolan, 2016; Auchincloss et al., 2014). The authenticity of the experience makes this work meaningful to students. Not only have CUREs been linked to science persistence, but course-based research also is said to provide a mechanism for increased inclusivity in STEM fields (Bangera & Brownell 2014; McLaughlin & Coyle, 2016).

Long before CUREs were discussed in STEM fields, the Boyer Commission on Educating Undergraduates in the Research University (1998) made sweeping recommendations for undergraduate education that also highlighted the importance of inquiry-based and discovery learning from the first year of college on. The report emphasized that research from the first year on was essential, with a developmental model proposed whereby more and more advanced research would be expected up through a capstone experience. Central here is the expectation that oral and written communication skills would begin to be practiced in the first year of college, resulting in students showing advanced signs of proficiency over time. In contrast to CUREs, which have been developed primarily in STEM disciplines, the Boyer Commission recommended discovery learning and student research as part of all students' undergraduate learning, both disciplinary and interdisciplinary and from before one selects a major on through the capstone experience.

Focus and Background of a Mentored CURE as Part of a First-Year Seminar

The CURE described in this paper stems from students' participation in a first-year seminar experience. Like at many universities, the first-year experience described here was designed to help build the intellectual and social-emotional skills necessary to thrive in college. All first-year students at Clark University are required to take a first-year seminar course and do so in their first semester. Most of the seminars for first-year students are small in size and focused topically on a theme of interest to the professor and students. Rather than being an introduction to a particular disciplinary area, most of the first-year seminars at our school are interdisciplinary in focus and all must fulfill one of the general education requirements in our Program of Liberal Studies. This particular class fulfilled the verbal expression requirement. While occasionally these seminars also function to introduce students to particular disciplines, this seminar (like most of the others) did not meet a major requirement, and the students first declare a major after their first semester and often not until their sophomore year in college.

The first-year seminar course described in this paper dealt with the interface between developmental psychology and the learning sciences. Although it was cross-listed in both the psychology and education departments, as noted, it met no major requirement. Some of the sixteen students who enrolled in the course have gone on to major in psychology or an interdisciplinary major housed in education, while other students have gone on to major in other social sciences, STEM, humanities, and performing arts fields of study. The research conducted by the 16 first-year students discussed in this paper was embedded in the first-year seminar experience. The students were diverse in various ways, with 81% of them as US citizens, 56% as white, and at the time of the class, 56% identified as female and 44% as male, and many identified as first-generation students.

After spending the first part of the semester reading literature and discussing the purpose of education and its impact at different points in human development, reading about theories of human development, and learning about the variety of cultural practices pertaining to student learning across the globe, the students began to work in small teams on a research project. The CURE involved using already collected survey data on college seniors' experiences with capstone and signature work, and in particular, examined whether the seniors in the study had publicly presented such work beyond the classroom. The first-year seminar students examined whether there were differences in categories such as gender, parent education level, or area of study between those students who reported that they participated in capstone or original inquiry work while in college and those who did not, as well as between students who did and did not present that work outside the classroom in a public way. The goals guiding the students' work were both to get the first-year students to reflect on the possibility of engaging further with research while in college and also to mentor them in an initial research process. This included involving students in disseminating their findings through creating team posters that could be presented at the university academic research festival the following spring. Further information about the project can be found in the appendix.

The experience also was designed by the professor to offer the first-year students the chance to reflect on their own learning in high school and college and to help them understand that research and its public presentation is not only possible, but noted to be a high impact practice. Following Dolan (2016), the aim was to provide a scalable and equitable introduction to what the research process is like. In addition to learning general critical thinking and research skills, this was also designed to help students plan to do future independent signature or capstone work later on, something, as noted above, too few students take part in during their college experience. And because prior research has highlighted the centrality to contribute to sharing novel findings beyond the classroom (Dolan, 2016; Wiley & Stover, 2014), it seemed important to have the first-year students aim to present their research projects at the yearly campus research festival where they would also have the opportunity to view research from all areas of study, as a springboard for them to consider future participation after they selected their major. In short, in addition to introducing students to critical skills central to the research process, the course aimed to help students better understand and reflect on the importance of mentored high-quality research experiences early on in their academic careers, as a mechanism to assure that all students could consider incorporating more advanced research experiences by the time when they reach capstone level.

Student Reflections on A Mentored CURE Embedded in a First-Year Seminar

Reflections One Year Later

The first-year student research project described above resulted in three poster presentations on factors associated with showcasing student capstone work (one on gender, one on parent education level, and one on area of study) completed in the Fall of 2019, and that were scheduled to be presented at our university's academic research festival in Spring 2020 (Acevedo et al., 2021; Alienello et al., 2021; Palmer et al., 2021). The COVID-19 global pandemic shutting down face-to-face learning in March 2020 led to the cancellation of the research festival. Naturally, it was disappointing that the opportunity to present was no longer available to us. In late Fall 2020, an invitation to all students announced that a special festival would take place in Winter 2021, which again gave our class the opportunity to submit our posters for presentation. We were excited to revive our efforts. When our university paused the Spring Semester start date and we had some extra time, it was then that the authors of this article decided to meet to write this manuscript. The opportunity to revisit our work after another year of study left us with many reflections on the importance of course-based undergraduate research experiences and the role of mentoring. In particular, we share reflections on what we learned about research, and the importance of mentoring to that learning. We also reflect on the impact of COVID-19 on our experience of and thoughts about the importance of students presenting publicly.

What We Learned: Research and Beyond

Our review of the literature discussed the importance of engaged learning and noted that most students have not been exposed during high school to the level of inquiry-based learning expected on college campuses. Prior work has highlighted that undergraduate research is a high impact practice and that a carefully mentored CURE experience can open up the opportunity for a wider group of students to engage in undergraduate research. Finally, the Boyer Commission report (1998) highlights the importance of students participating in research experiences, starting as early as in the first year, for their academic development. We turn now to share student perspectives on aspects of the experience that we have carried with us. Our reflections highlight skills and capacities related to our understanding of research, but also point to learning that has guided our academic coursework and development more generally.

Many of us and other students in the first-year seminar noted that we came to Clark University because of the significant opportunities for undergraduate research. One of us even wore a research sweatshirt to the first day when our class met up during orientation. However, we never expected to

engage in research until at least our junior or senior year. When asked by our mentor to reflect back on how we thought we would become involved in research, we realized we had given little thought to that. While we might have wanted to engage in research, we were not necessarily clear about how to get involved or what specifically it would entail. The CURE gave us insights into the research process and paved the way for future experiences. As one of us noted, "*I had always imagined my entrance into research through an application for a formal research project, a process that would likely be extremely selective and only undertaken by upperclassmen*." Another said:

> *As someone who is continuing to do research with other professors, and is looking to do further research beyond this, I believe that participating in this CURE provided me with a solid foundation for conducting research, and would allow me to effectively contribute to any research groups I would be a part of*.

Because the experience took place early on and was embedded in the first-year seminar course, we felt more confident about our plan to do independent research later in our studies. The experience also changed how many of us thought about learning and presenting research. We were not looking for the right answer, and it was not a test. We had to figure out what made sense to *us*. Unlike other early undergraduate "lab" experiences that are part of larger lecture courses, there was not just one solution, and the professor really did not know what we would come up with. Having a mentor who knew how to support us was critical. She kept us moving toward the goal of presenting a poster on our findings at the university's research festival. These reflections highlighted ways that our mentored participation in the process of authentic research gave us great insights and experiences pertaining to research to draw on later in college.

Learning through a mentored undergraduate research experience taught us a lot about learning in ways that go beyond learning about research per se. We have identified three practices we engaged in through the CURE that have served us well in college in ways that go beyond understanding the research process or how psychologists engage in research. These three areas include: student agency, navigating collaborative work, and iterative cycles of improvement.

Student agency. As first-year undergraduate students, the idea that we would pick themes within a broader project that interested us to work on was new to us. For most of high school, there was little choice involved and our behaviors and workload were determined by what others asked of us. Therefore, one new piece of learning had to do with us taking ownership and responsibility for our academic work. At times this was hard, but it was also transformative. One of us remembers an exciting experience of being able to request further data from the professor to help figure out patterns in the data that we did not understand. The request for additional data was a pivotal moment for the group in that it provided an opportunity for assuming ownership of our work. Taking ownership of the process significantly impacted our sense of ourselves, and made the class seem so much more worthwhile. Learning to own our education has continued to feel critical since the end of the first-year CURE.

Navigating collaborative work. This was one of the first times for us to experience learning in a setting where we had to work with people who were not necessarily our friends, and also who came from different backgrounds. Sometimes we came with different ideas (scaffolded by the homework assignments each of us were required to prepare in advance of the class meeting), and we learned that the goal was not simply to convince others of our own views, but rather to discuss each of our ideas in ways that typically led to a totally novel way to think about the research. This process was very interesting and will be helpful as we move beyond college regardless of whether we do research. Students appreciated working in teams because the work could be divided up and some of us could focus on particular parts based on our interests and strengths. We learned to figure out what we

each brought to the team, to reflect on our strengths and our shortcomings, and to build around them. Again, we might not have organized our group work this way if the class was not heavily structured to encourage us to do so. We can easily imagine the situation where one student would aim to just get the work done and the others would have agreed.

Not all of our collaborations were positive experiences, but we learned a lot here too. For instance, not every student approached the project with the same passion, and while most students engaged with the topic, some were not engaged. As a group and with the help of a mentor, we learned to deal with this dynamic:

> *There were some instances in which our group had to work around some group members not pulling their own weight, but I think that provided me with valuable experience in finding ways to work around group members that weren't willing to put the same amount of effort as other members. I feel that those skills were some of the most important things I picked up from this research task. I believe that I'll have an easier time navigating group conflicts in the future.*

Iterative cycles of improvement. One very powerful learning experience was realizing that our first interpretation and write-up was not the last. Often, we needed to dig deeper and perfect our analyses and posters multiple times. In addition, having extra sets of eyes from other teammates, as well as our peers on other teams and our mentor, also helped in the creation of the poster and in improving the writing. There were so many drafts and seeing the poster improving over time was another benefit to authentic learning. We were not tested to see if we "had" the knowledge, but rather were encouraged to work with our teams with the allotted time to improve our own and others' thinking about our topic. Most of us had not had experience with building time in for iterative improvement, and this was another skill we carry with us to other college experiences.

Student Perspectives on Salient Practices in Mentoring

Shanahan et al. (2015) identify ten salient practices of faculty mentors of undergraduate research to ensure student engagement. They note the practices can be divided into roughly three stages of research: planning, researching, and disseminating the findings, though they are clear that these practices "are iterative and not directly linear" (Shanahan et al., 2015, p. 4).

It is important to state that although we noted above that student agency was central to our CURE, at the same time, having a mentored course-based undergraduate research where the instructor held control of the planning (practices #1–#3) had lots of advantages. We have come to realize that pre-planning is essential to our experience. The mentoring provided a structure that gave us a sense of how all the pieces worked individually and together. The complex way the weeks fed into one another was very different from other kinds of work we often have done in the past. It was essential to have someone guiding us and keeping us on track as newcomers to the experience. As new college students, our time management skills needed developing and we were clueless regarding each step in the research process. Therefore, without guidance during the semester we would not have been able to achieve the final products that we did. Mentoring also allowed for there to be one central project with various sub-teams developing expertise and capable of understanding the work of the other teams in specificity. While there has been lots of focus on the importance of high impact practices and original work for student development, mentoring plays a key role in structuring that interest in successful ways.

Furthermore, as students we never would have had the capacity as new researchers to plan out in advance three interlocking projects. Our groups would have each worked on separate projects if we went solely with our interests. Because our mentor had a command of the broader literature, she was able to set clear expectations and ask questions that led us to think further. She also connected

us to resources when we needed help. In addition, we built off earlier readings from the first weeks of class and use that common knowledge as a base.

Our professor built structure into the enactment of the research process, asking us to divide into three smaller interest-based teams. The data were already collected, and a number of demographic features were included in the original survey that formed the basis for our research. The class discussed our interests and the students selected three demographic features and broke into teams based on our individual interests. The three teams all used the same data set so there could be connections between the three team projects, while giving students a chance to focus on an area that was particularly interesting to them.

Several of us felt that the mentoring we received about the research process can scaffold us in future work: "*I think that having a mentor like Professor X to help me break down the steps of the research process* (practice #2) *helped deepen my understanding of how research functioned, and is something that will aid me whenever I conduct research in the future."* Furthermore, a student added, "*having knowledge of the research process has made me much more willing to partake in projects or classes with a research component*. *In addition, Professor X allowed my group to explore aspects of the data that we weren't originally provided by giving us increasing responsibility for our work as a team over time* (practice #7), *helping us become more personally involved with data that we were able to analyze from scratch*." Another student commented on the centrality of our mentor structuring the process of research as being in a community with mutual support (practice #5):

> *Making the groups of students small also led to a lot of one-on-one support from the professor both during and outside of class. During class, the professor was able to meet with each group individually multiple times to discuss findings and to make sure everyone was on the same page. We were also able to ask questions and collaborate alongside the professor in this setting instead of feeling like we were alone and left to figure it out by ourselves. Professor X made us feel like we were part of her research team instead of just her students*.

The third broad category Shanahan et al. (2015) consider is the dissemination of research. While we agree dissemination is important, from our student perspective, we saw an important aspect of dissemination that goes beyond what has been discussed. There is no doubt that learning about the university's research festival and various publication outlets has been central to our understanding of what scholarly research entails (practices #8 and #10). This knowledge goes far beyond the conception of research we received in high school, where contributing to ongoing scholarship was not emphasized and getting facts right was valued. We also believe that the iterative writing and feedback cycles we engaged in as we prepared to disseminate our work has taught us a lot about scholarly communication. We would not have known the various avenues for dissemination had we not been mentored in class about these. At the same time, because of the global pandemic and COVID-19, the format of the research conference changed to an online venue and there was some powerful learning that we believe is worth discussing. We turn now to this topic in the hopes that mentors and campus leadership related to undergraduate research keep this in mind as they consider how students disseminate new research on their campuses.

The focus of our CURE research as first-year students was on whether or not seniors at four colleges and universities reported presenting inquiry-based work publicly. Ironically, our own presentation was postponed in Spring 2020 because of COVID-19 and first took place in Winter 2021. While the research experience was valuable, our experience publicly presenting turned out to be not exactly as we hoped for. Nevertheless, we believe our experience provides an opportunity for future learning about what is important about the dissemination process for us as students. First, we must emphasize that the idea that as first-year undergraduates, we were informing others on campus

about the importance of capstone presentations of seniors was very empowering. What was especially significant about the experience as we reflect on it was the progress we made in developing public speaking skills, showing knowledge of material, and feeling like we had some expertise in our area of research.

A year later when we had the opportunity to present our research, the experience of the actual presentation did not go quite as planned. It had been a year and we had to get back into our work and thoughts about the research. We were excited to share our research with others and discuss the topic with other interested individuals in the community. In the end, we learned a powerful lesson. While the campus festival is typically a face-to-face event with significant discussion and engagement, due to COVID-19, it was held online, resulting in the showcasing aspect becoming more central to the audience. People downloaded our three posters, but the event allowed participants to ask questions through a learning management system. This option was rarely exercised. This experience taught us in a powerful way the difference between "showcasing" our work for others to *see* versus having the opportunity to *discuss* it with others. We realized how central discussion is to our learning. We were excited about the possibility to engage with others about our research. As students, the desire to present our work is not simply to showcase or disseminate it, although we recognize how important this is to the research process. Rather, we are anxious to share and discuss, answer questions, and describe next steps. While putting the poster together and seeing it advertised and posted in the digital archive is rewarding, we realized that discussing the work is equally important for students to gain benefit. We are glad we will have further opportunities to experience discussing our research with others. Based on our mentored undergraduate course-based experience we will pursue that option in the future.

Other Mentoring Practices We Found Helpful

We also considered whether we felt certain practices related to the organization of the CURE were central to our experience that have not been identified directly in the list of salient practices identified by Shanahan et al. (2015). We feel it is particularly important for mentors to organize the CURE so that small teams work on projects related to a larger whole, rather than one large class project or having every student do an individual project. We all benefited from being able to learn from and provide assistance to the other teams, especially because of the interconnection of our projects. The course was set up so that there was time for teams to update one another and ask questions. Often this is done once at the end of the semester after a group has presented, but this method of our class working on three sub-themes allowed us to "skip the fluff" and dig into the meat of the issues as the semester moved along and we came to know one another's projects. The way the course was structured allowed us to have significant opportunity for peer mentoring and it allowed us to give productive feedback and learn to phrase our feedback in constructive ways.

Improving Mentorship in the First-Year Seminar

The CURE undoubtedly helped us transition to college-level work and aided our development as students. As with any experience, there are areas of potential improvement, and three are identified here. First, our groups were formed by interest. Although that made the work interesting to us, some of the groups were larger than others, and we noticed that the size of the group makes a difference. In our experience, having groups with more than four students was less beneficial in that some students became less visible and perhaps less involved. We recommend using smaller groups that encourage each student to take on a more active role in the experience. Second, scaffolding is essential, but in some ways the process was so smooth that students rarely had the experience of struggling and pursuing solutions to challenges. While we made multiple drafts of our work, and this was a good experience, it may also be appropriate to allow students to struggle more and create space for students to signal the need for additional support. There is always a balancing act for determining appropriate levels of instructor support. Our advice is that instructors should give

significant thought and not undervalue the importance of allowing students to fail. Third, another improvement we suggest is to invite students who previously completed the course or other CURE experiences to share their experiences with the class early on, as a form of peer-to-peer learning.

General Discussion

We have only experienced a CURE embedded within a first-year seminar and have no way of knowing whether other first-year seminar formats might also have eased our transition to college. We do know that the introduction to inquiry-based learning and communication paved the way for us to better understand what level of work is expected at college. The chance to explore authentic research over the course of the semester with our peers in a semi-structured format taught us a lot. We all obtained valuable information about what the process of doing research is like, and a range of skills and practices that could flexibly be employed in other courses regardless of our major, such as the importance of student agency, lessons about navigating collaborative work, and the importance of iterative cycles of improvement. Of the fifteen students in the original first-year intensive seminar, 53% participated in additional mentored research on campus by the end of their first semester of their junior year, 40% of the enrolled students have not participated in additional research experiences yet, and no further information is available for one student (7%) who left the institution. All students, regardless whether they have participated in additional research experiences or not, have noted that learning gains from the CURE have been transferred to other experiences, such as participation in entrepreneurial course projects and curricular activities associated with other majors.

While COVID-19 hindered our original presentation of the data, there was a silver lining in having the chance to come back as sophomores to discuss, refine, and present work from our first semester in college. We were surprised at how far we got without much in the way of background and how much we learned in the process. Seeing our work presented alongside much older undergraduate students was motivating, especially when we saw that the work we did looked as ambitious as other projects. Especially early on, having that opportunity to interact directly about authentic research is central and should not be underestimated. We look forward to being able to present further research someday in a format that is more interactive, where we would have the chance to discuss the ideas of our work and not simply showcase it for others to read. One major lesson we took from this mentored experience is the importance of collaboration and entering a community of scholars in order for research to have impact. Research does not end with one study but enters into a dialogue with others.

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Appendix. More Information About the Project

Who Participates in Showcasing Capstone Work

The research question focused on in this course-based research experience examined college seniors' participation rates in presenting signature work publicly. While there has been some discussion of who participates in capstone work and original inquiry on college campuses (Budwig & Alexander, 2020), less is known about presentation and showcasing such work (Dolan, 2016).

Method

Participants

The survey sample included 291 college seniors from four schools participating in the AAC&U's LEAP Challenge which facilitated campus leadership for signature and capstone work. Seventy percent of the participants (203) identified as female, 25% (74) as males, 3% (10) as another gender, and 1% (4) did not answer or noted they preferred not to answer. The students came from families with various educational levels: 25% noted their parents' highest educational degree was less than a BA/BS and 75% indicated their parents had educational degrees of a BA/BS or higher. The seniors completing the survey came from different majors: 43% were science majors, 22% majored in the social sciences; 19% indicated a major in the humanities; and 10% in the arts, with the remaining 3% did not provide a major.

Survey Instrument

This study is based on a larger survey asking the seniors questions related to participation in project based experiences that integrated and applied their learning and whether they had the opportunity to publicly present this work. In addition, students were asked several demographic questions. The research described here focused specifically on the public presentation question examined in light of three demographic questions pertaining to gender, parent education level, and area of study. That question asked students to indicate if their project included the presentation of public results (shared beyond the class, for instance at an on campus event, a conference, shared with the school community, off-campus, journal article, etc.). The students could respond yes (completed or ongoing) or no such experience.

Procedure

Four schools participating in the Association of American Colleges and Universities LEAP Challenge agreed to invite graduating seniors on their campuses to complete the anonymous survey and responses were gathered from 291 students. The survey took individual students approximately ten minutes to complete. Only the lead researcher knew the identity of the four schools participating in the project. The study was approved by Clark University's Institutional Review Board before the research commenced.

Results

The results were analyzed for the question about whether the seniors presented original work publicly beyond the classroom in terms of students' reported gender, parents' educational level, and seniors' area of study.

Gender

The first set of analyses examined whether there was a difference between genders on likelihood to publicly present capstone research. Reported gender was used as the independent variable in our analysis, with the dependent variable measured as whether or not students reported

presenting publicly (Palmer et al., 2021). A chi-square test for independence indicated no significant difference in the proportion of males or females that presented, $X2(1, n = 277) = 1.7137$, $p > .05$. Further analysis considered individual variation in the presentation rates at each school based on student gender. There were no noteworthy differences between males and females were identified at the four individual schools. Too few students reported "other gender" and so could not be included in the analysis.

Parent Educational Level

A second set of analyses sought to find out whether or not the education level of a student's parents (and thus, their status as a first-generation college student or not) would have an effect on whether or not students presented their work publicly. The dependent variable was whether or not students reported presenting work publicly, and the independent variable was whether or not the students identified themselves as "first generation" (parents with an educational level below a BA/BS degree) or "not first generation" (parents reported to have a BA/BS degree or higher). The analysis of students across schools examined the presentation rates across first generation and non-first-generation students. A Chi square analysis revealed no significant relationship between first-generation status and rates of presentation ($X2$ (1, $N=291$) = 0.146, $p = 0.702$, $p> .05$. Although there were between school differences, no one pattern was found and warrants further examination (see Acevedo et al., 2021).

Area of Study

A third set of analyses sought to discover whether a student's selected area of study corresponds with whether or not students presented original work publicly. The dependent variable used in these analyses was whether or not students presented their work. The independent variable was student's reported area of study with the choices being science, social science, humanities, or the arts. A chi-square test for independence indicated a significant difference across the four areas of study in regards to the likeliness to present, $X2(3, n =283) = 12.5966$, $p < .05$. Looking more closely at the variations between schools, several patterns were observed that indicated individual school level differences. No one pattern was found, but disciplinary differences existed in which students reported having presented work publicly within and across the schools (see Alienello et al., 2021).

Discussion

Students at the LEAP Challenge schools reported participating in and publicly presenting their projects. Neither gender nor first generation status impacted presentation rates on these LEAP Challenge campuses. This is encouraging in that Finley & McNair (2013) described differences with regard to participation in high impact practices and engaged learning opportunities. In contrast, area of study did make a difference in terms of who presents publicly, and this finding suggests the need for further examination to determine what leads students in some disciplines to be more likely to present than others. The findings of the three analyses indicate that institutions can play a role in providing opportunities for students to engage in original work and by providing opportunities for students to present publicly. Given the importance identified for participating in and publicly presenting original inquiry, and low rates indicated for student participation in prior work, these findings have important implications.