ISSN 2688-5999

Applied Economics TEACHING RESOURCES

Volume 7, Issue 1, December 2025

Special Issue: Undergraduate Research in Agricultural and Applied Economics– Part 2
(Special Guest Editors: James Sterns and Jason Bergtold)

AAEA Agricultural & Applied Economics Association

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Applied Economics Teaching Resources

Applied Economics Teaching Resources (*AETR*) is an online, open access, and peer-reviewed professional publication series published by the Agricultural an Applied Economics Association (AAEA).

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Applied Economics Teaching Resources

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Teaching and Educational Method

Fostering Undergraduate Research with Rising Student Demand and Shrinking Faculty Resources: The Saturday Morning Breakfast Club

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JEL Codes: A22

Keywords: Mentoring, publications, returns to scale, teams, undergraduate research

Abstract

The Iowa State Economics Department's Saturday Morning Breakfast Club mentors undergraduate research in a group setting rather than one-on-one. The group setting allows students to learn from each other and takes advantage of returns to scale in mentoring compared to the traditional one-on-one research advising. The switch to this model allowed us to greatly expand opportunities for undergraduate research despite shrinking numbers of faculty and rising numbers of students seeking research experiences. The quality of the research experience is evident in the number of placements in national competitions, refereed publications, and student reactions to the experience.

1 Introduction

Increasingly, high school graduates are coming to college having already completed a number of college credits. These were earned in some combination of dual credit courses, defined as a class that fulfills both high school and college credits, Advanced Placement (AP), or International Baccalaureate programs. Figure 1 shows that the number of high school students earning AP college credit quadrupled between 2000 and 2019 to reach 2.8 million by 2019. Barshay (2023) reports that the number of high school graduates with dual-enrolled credits in community colleges also quadrupled over the same period to 1.05 million by 2019. With 3.8 million high school graduates per year, over half are now entering college with college credits earned while in high school.[1] Many begin college with a semester or more of coursework completed and will enter their senior year having completed the mathematics, statistics and economics courses required by their major. These students may be well-prepared for conducting a research project, and many may stay for a fourth year for that opportunity.

The standard model of undergraduate research has mirrored that of graduate students. Undergraduates work one-on-one with an adviser on the student's project, or the student provides research assistance on a professor's project. This is still the model for the senior essay required at many private schools where there were 8.5 students per faculty member in 2020. Average student-to-faculty ratios have fallen over time at public universities (Figure 2) to 14.8 by 2020. However, student-to-tenured-faculty ratios have been rising over time and reached 33.6 by 2020. The trends of rising numbers of public university students ready and willing to conduct research with fewer research faculty available to advise them spell shrinking undergraduate research opportunities in public schools. The problem is exacerbated by the lack of institutional incentives to work with undergraduate students, and so relatively few faculty are willing to engage in undergraduate advising.

[1] In 2009, 42 percent of high school graduates had earned college credit in high school, the most recent data reported in the U.S. Department of Education, National Center for Education Statistics, High School Transcript Study. Since then, the number of students taking AP and dual credit classes increased by nearly 75 percent.

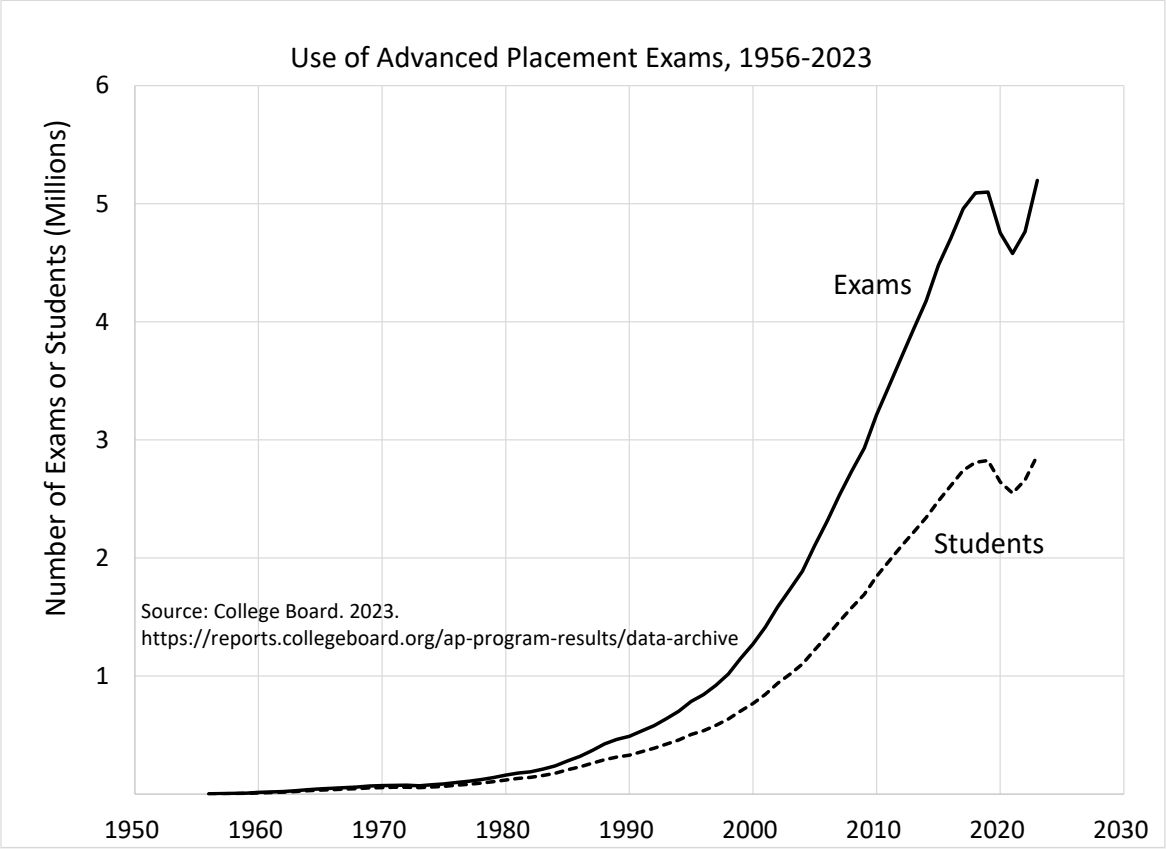

Figure 1: The Total Number of Advanced Placement Students and the Total Number of Exams Completed by Year, 1956–2023.

Some universities have met the challenge by offering capstone courses in research methods. While such courses indeed broaden the number of students served, they often achieve their economies of scale by limiting the range of topics and methods a student may use. At Iowa State University (ISU), we tried an alternative means of scaling up research opportunities without standardizing the topics or methods. Our Saturday Morning Breakfast Club strategy is more akin to a research-group model than a one-on-one model. Through a group dynamic and the addition of graduate teaching assistance to the process, we aim to exploit returns to scale in research advising to increase the productivity of scarce faculty time.

It is useful to discuss why a public university should encourage undergraduates to engage in research when it lacks the comparative advantage to provide such services compared to liberal arts colleges. The first is that land-grant universities must develop the next generation of scholars in agricultural economics, and passively waiting for undergraduates to self-identify will not motivate the best and the brightest. Furthermore, students may only realize their talents for research after they obtain research experience, making early exposure a useful screening mechanism. We argue that the Breakfast Club serves to develop future graduate students and provide undergraduates with the chance to build a research portfolio that will follow them into their professional careers.

A second reason to offer a research outlet to undergraduates is that it motivates high-achieving students, who may be able to graduate early, to stay for a fourth year. With state support for public universities waning, tuition is the only growing source of revenue. Colleges and universities already face

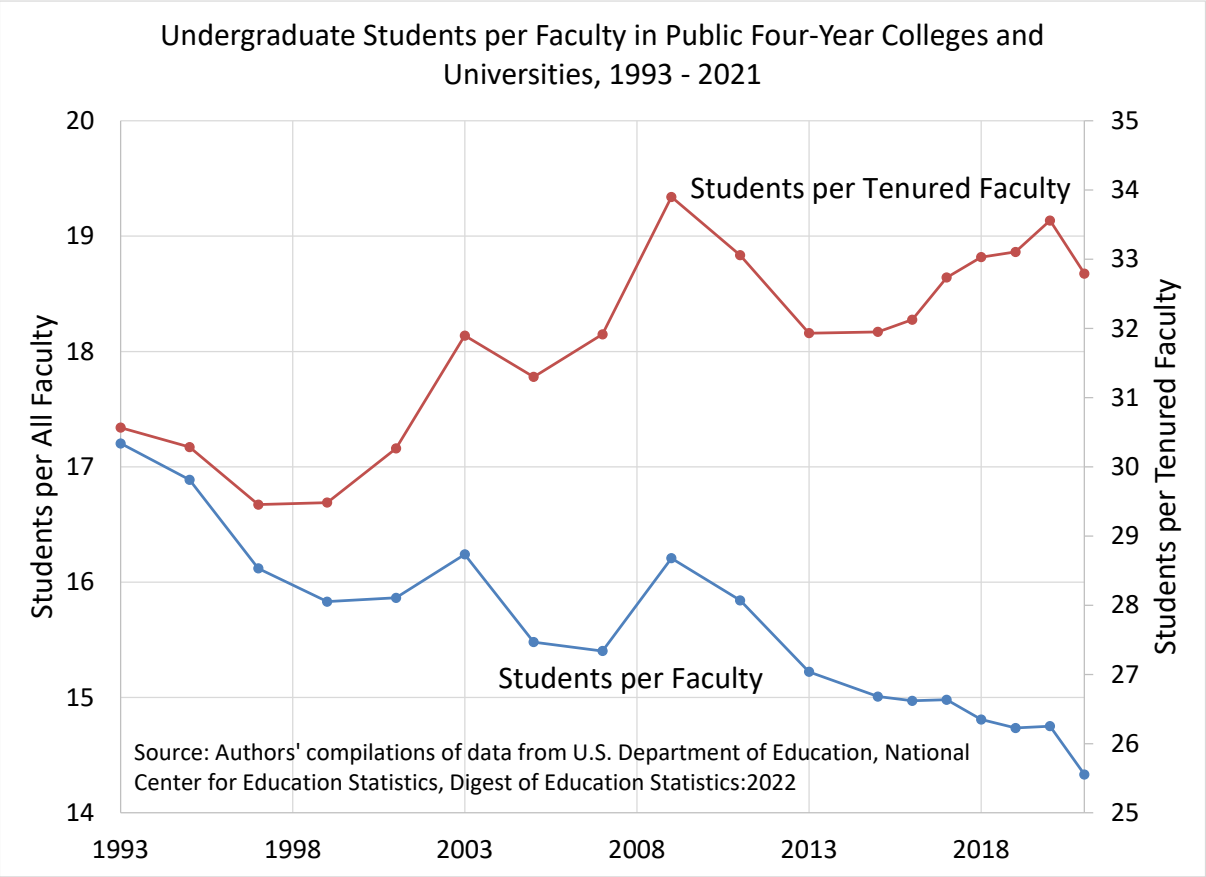

Figure 2: The Ratio of Students to All Faculty and to Tenured Faculty, 1993–2021

an upcoming enrollment cliff that will decrease the number of high school graduates enrolling.[2] The problem will be exacerbated if the students entering college have enough credits in hand that they only stay for three years.

The third reason is that the student's research experience serves as a way of differentiating themselves on the market. As one example, one student told us that the employers at the university career fair only wanted to talk about her project because the research skills she acquired made her more interesting to firms.

This paper will present a case analysis of the ISU Economics Department's Saturday Morning Breakfast Club,[3] an effort to expand undergraduate research opportunities despite shrinking faculty positions by exploiting returns to scale. By switching to a model of group research advising and increased research partnerships between graduate and undergraduate students, we were able to expand the range of undergraduate research opportunities, including solo or joint research projects, and team research for national competitions. In addition, Breakfast Club participants presented their work at national and regional professional meetings. The club fostered submissions to and publications in professional journals as well as designing and conducting Extension research and building resumes for admission to graduate and professional schools.

[2] Nayga, Liu, and Kassas (2024) report that declining fertility will result in a projected 10.4 percent decline in the number of U.S. high school graduates after 2025. This will have a particularly large adverse impact on college enrollments in the Midwest and Northeast.

[3] The name was inspired by the 1985 John Hughes film of the same name, but from the start, we provided fruit and pastries because students might attend past the noon hour.

2 The Iowa State Breakfast Club Model

The ISU Economics Department's Saturday Morning Breakfast Club began on a bus ride to Omaha. Since 2014, the ISU Economics Club has taken an annual trip to the Berkshire Hathaway annual meeting. The so-called "Woodstock for Capitalists" provided students a glimpse of economics in practice as CEO Warren Buffett and his right hand, Charles Munger, answered questions in their folksy style about business strategy, politics, regulation, and life. During the trip, two students discovered that they were each working on a research project, but they were unaware of each other's efforts. Why, they asked, did we not have a way for undergraduates working on papers to interact? And so, the Breakfast Club was born.

The Breakfast Club model is a drop-in workshop in which a small number of experienced researchers provide advice and collaborative support to undergraduate researchers. The assigned experienced research advisers include one faculty member and at least one graduate student. Undergraduate advisers identify students who have an interest in conducting research and refer them to the Breakfast Club faculty member, who then discusses possible topics with the student and the student's time frame for completing a project. In our experience, some students start projects during their freshman year, and so relatively ambitious projects can be undertaken that are planned to take multiple years. Others may have to finish in a semester, and so they carry out more limited projects. In several cases, two students were interested in the same topic and worked on a project together.

The Breakfast Club need not be a formal class in the sense of a research seminar. At ISU, some students participate without credit in each semester, although most register for independent study credits at some point. These credits are offered on a satisfactory-fail basis. The lead faculty member may serve as the primary research adviser, or another faculty member may be recruited depending on expertise. However, the Breakfast Club faculty and graduate students agree to assist on the data collection, statistical analysis, paper design, and writing. This frees up the other faculty to focus on content advising. Sometimes, the student's project overlaps with another graduate student's interests, often because of the use of the same data set. In those cases, that graduate student may be invited to join the project as an adviser or coauthor. As a result, there are more personnel involved than just the original two, but the Breakfast Club personnel specialize in the day-to-day support and training.

From the beginning, the undergraduate research program followed these strategies:

1. Every student who wanted to participate, as long as they understood the expectations, was allowed to join. Some students who had been marginal performers in their coursework blossomed when they found out how to apply their skills to data.
2. Students work on their own projects. None served as research assistants on a faculty project. Once a student identified a topic or area, the faculty member and the student hashed out a project that could be feasibly completed in the time available. Each project was novel, and it was hoped that it might develop into a publishable paper depending on the student's commitment and whether the data exploration proved fruitful.
3. Projects could span one semester, several semesters, or several years depending on the number of remaining semesters in the student's program.
4. The pace of the work ebbs and flows, as students' course work had to take precedent.
5. Students were encouraged to discuss their projects with other students. Often, more senior students help new students with research methods.
6. Some group sessions were held for all participants on topics such as "How to design a research strategy," "How to do a literature search," "How to organize and write a paper," and "How to use Stata."

7. We met on Saturday mornings when students would have no conflicting academic obligations. While separate sessions could be arranged, if necessary, there were gains from complementarities when there are multiple students. The sessions could last for several hours, especially if we were cleaning data or conducting statistical analyses. In general, the student received assistance as long as they wanted help.
8. While students were encouraged to generate a paper, the value in the exercise is gaining research experience. Students who attended in order to satisfy independent study credits were given a satisfactory grade based on the effort, as students learn from the process whether or not it succeeds. Many students did not complete their projects, but many others completed papers, and a few managed to publish in refereed journals. Students are more comfortable trying the unknown when they are not afraid that the lack of success may result in a bad grade.

In addition to traditional paper-oriented research projects, the Breakfast Club model also supports team development for student competitions sponsored by professional development organizations. Group competitions are opportunities to provide research advice on the same topic for many students in a single instance, and so they are a source of returns to scale. Team competitions create complementarities between student researchers and allow the adviser's time to benefit all team members at once. A few of the more prominent competitions considered by ISU Breakfast Club members include:

- The iOMe Challenge (https://iomechallenge.org/iome-challenge/) sponsored by St. Norbert College where a team analyzes a policy question;
- The Federal Reserve's National College Fed Challenge (https://www.federalreserve.gov/conferences/fedchallenge.htm) where teams evaluate economic conditions and propose monetary policy; and
- The Federal Deposit Insurance Corporation (FDIC) Academic Challenge (https://www.fdic.gov/analysis/academic-challenge/) where the team evaluates an issue facing the banking industry.

It is useful to start with one competition because there is a steep learning curve in participating. It is also important to select a well-managed competition as poorly functioning websites, unclear rules or scoring rubrics, or poor feedback will only frustrate students and limit the learning experience.

A third way for students to share their research is to present their work in a professional setting. Lists of undergraduate conference opportunities and journals that cater to undergraduates are maintained by the American Economic Association (https://www.aeaweb.org/resources/students/undergrad-research). Some of these conferences hold competitions. Although students can be very nervous before presenting, our experience has been that students uniformly felt positive about the experience. As we never forced the issue, it is also plausible that only those prone to appreciate the experience went through with it.

In Figure 3, we show what happened to the number of undergraduate students who signed up for research credits in an academic year. The data understate the total number of students participating in the Breakfast Club. There are two reasons for this. First, the five students who made up our case study team starting in 2017 are excluded because they did not receive research credits for their participation. Second, students typically sign up for their research credits in one semester, even if they work on their project for as many as four semesters. Nevertheless, even the understated measure shows that the

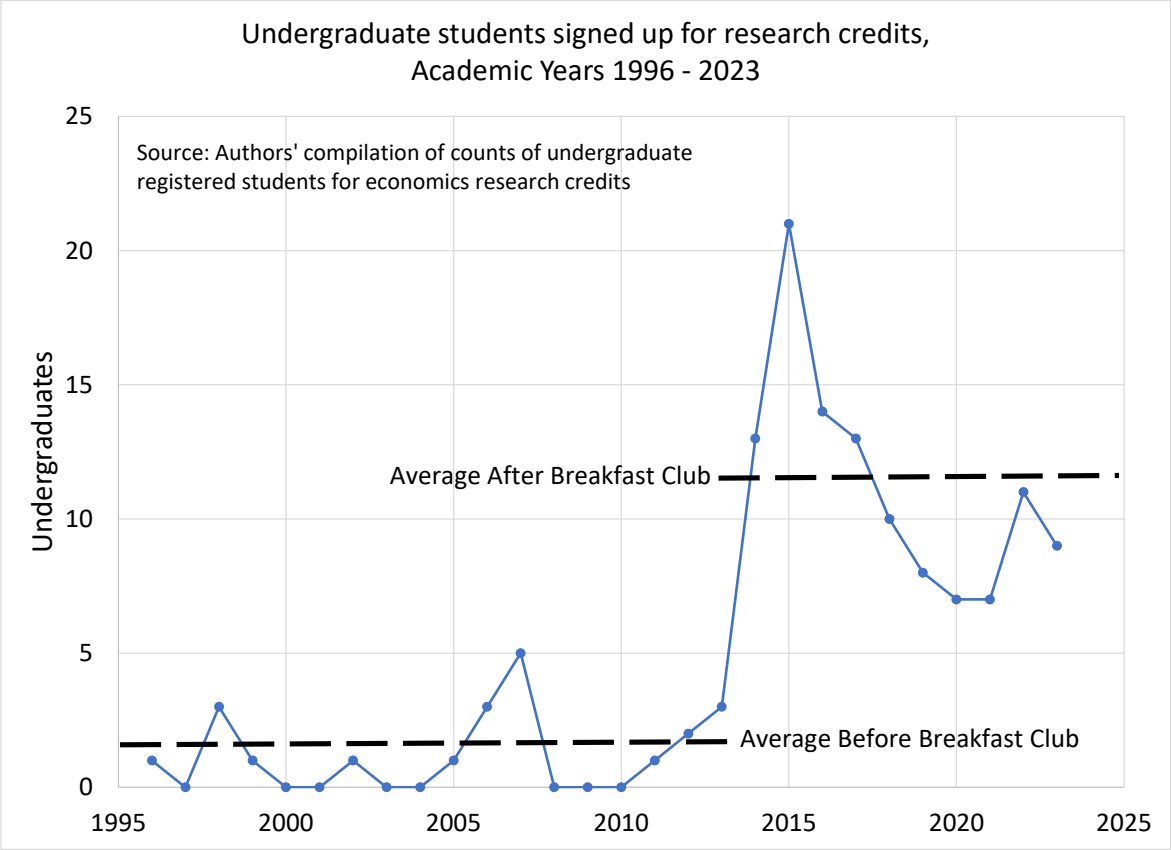

Figure 3: Iowa State University Undergraduates Enrolled for Economics Research Credits, by Academic Year, 1996–2023.

number of undergraduates conducting research increased dramatically when we switched to the group advising strategy.[4]

3 Benefits of the Breakfast Club Model

Undergraduate research develops communication, analytical, technological, and problem-solving skills (Russell, Hancock, and McCullough 2007; Wayment and Dickson 2008; Nolan et al. 2020). The collaborative relationships between undergraduates, graduate students, and faculty fostered by the Breakfast Club offer some additional benefits.

3.1 Benefits to Undergraduate Students

One major hurdle the Breakfast Club overcomes is the student's view of unapproachable faculty. Oftentimes the lack of student interest in research may be an incorrect view that faculty are intimidating or unapproachable. In a one-on-one model, the student must seek out a potential faculty adviser. Most undergraduates will not have the background to formulate a promising research question. But even with a topic in mind, students may not know which faculty member could advise. Under the Breakfast Club model, students already know the research experience is available and exactly which faculty member to

[4] The university shut down in Spring 2020, but resumed masked face-to-face advising in Fall 2020. The pandemic did affect the number of participating students in 2020–2021, but the numbers rebounded thereafter. At least part of the reason is that our advisers suggest the Breakfast Club to promising students during their course scheduling meetings, and the advising sessions were also disrupted by the pandemic.

contact. The topic will follow. Additionally, working with other undergraduate students and graduate students might be less intimidating than working directly with one faculty member.

As with a typical one-on-one model, the Breakfast Club provides undergraduate students with research experience that increases their exposure to advanced econometric methods and statistical software. Perhaps equally valuable is that the Breakfast Club encourages collaboration with other undergraduate students. With a common meeting time, the undergraduate students have the opportunity to discuss their research projects with each other, share ideas, and jointly problem-solve. One of the most popular activities is when one student proposes his/her research idea, and all the students throw out suggestions, concerns, testable hypotheses, or possible alternative questions. The peer learning is not just that students may be facing a similar obstacle, but that they can learn about a completely different challenge being faced by their fellow students.

3.2 Benefits to Graduate Students

At ISU, one faculty member oversaw the Breakfast Club along with one graduate student Teaching Assistant (TA). More recently, previous TAs drop in to help if they have a paper with an undergraduate that is continuing from a previous semester. During mentoring/advising meetings, the faculty member and graduate student divide their time assisting students working on identifying relevant literature, cleaning data, developing models, and conducting data analysis. The work is similar to triage—most undergraduates can work independently if they have access to assistance when they get stuck. Graduate students provide guidance and mentorship to the undergraduates and refer the most challenging issues to the faculty member. This is a great opportunity for graduate students to develop their mentoring skills. Being a good mentor takes time, experience, and patience, so encouraging early-career development of these skills gives graduate students a head start on becoming better future mentors.

The Breakfast Club also provides graduate students with teaching opportunities. Important research-related skills such as in-depth literature reviews, econometric techniques, and statistical software use are not always included in the undergraduate curriculum. While many of the undergraduate students who engage in research, are motivated self-learners, they often need guidance on important concepts. The graduate students create a one-class lecture based on the specific needs to the undergraduate students in that semester, such as an introduction to Stata or R. With limited teaching opportunities, these one-class lectures provide the graduate student with valuable teaching experience as a preparation for a career in academia.

The Breakfast Club provides graduate students with the opportunity to work on research outside of their dissertation chapters. Almost all TAs have had at least one joint project with an undergraduate, helping to diversify the graduate student's portfolio leading into the job market.

3.3 Benefits to Faculty

One of the major challenges of undergraduate research projects for faculty is the amount of time devoted to just one student conducting one research project. This challenge is amplified if mentoring holds little value during the tenure process. Because the Breakfast Club faculty member and TA specialize in providing assistance on the more basic aspects of assisting undergraduates, other faculty can focus on helping define the research topic and plotting the conceptual design. Specialization according to comparative advantage is the key to the creation of returns to scale in undergraduate research mentoring.

It is a bit more complicated to generate a publishable paper. With rare exceptions, producing a paper of sufficient quality to generate a revision request and ushering it through the revision process will require the participation of the graduate student and faculty member as coauthors. In our experience, only a few faculty with particular interest in the topic were willing to carry the project all the way through the publication process. It is more common that faculty aim for a good senior essay or

honors project.

4 Student Success

Most of our students have participated in individual research projects. We encourage students to present their work if they complete a paper. Each semester, the University Honors program hosts a poster session and paper presentation day. This is open to non-honors students as well. Students can also present a poster at the Iowa State Capitol to audiences of state legislators.

For the bravest, there are numerous opportunities to present papers at regional or national conferences. Our students have presented at the undergraduate sessions of the Midwest Economics Association (MEA), the National Conference on Undergraduate Research, The Dallas Federal Reserve's Economics Scholars Program, the Southern Regional Science Association, and the Agricultural and Applied Economics Association (AAEA). Since 2015, Breakfast Club participants have finished first twice and second once in the AAEA paper competition and placed three times in the AAEA spreadsheet competition. We have had two students place in the MEA competition. Some of the conference presentations have unexpected benefits, as when two of our undergraduates were hired by the Dallas Fed after giving their talks.

Our research team outlet has been the Conference of State Bank Supervisors Community Bank Case Study Competition (https://www.csbs.org/policy/tags/case-study-competition), which involves a team partnering with a bank to analyze the bank's business plan and past and potential future performance in the context of a chosen research question. The team writes a twenty-five-page paper and develops a five-minute video summary of the case. We were encouraged by an alumnus who was also the Iowa State Superintendent of Banking to give the competition a try. The combination of applied microeconomics and business suits our students' comparative advantage. In the seven years that we have participated in this national competition, we have finished in the top five, three times.

Another test of the strategy is whether students can produce a publishable paper. Fifty-six students initiated a research project, and another twenty-seven took part on a bank case study team. Twenty-one students have had a part of ten refereed publications, although ten of the students with a publication were members of a bank case study team whose case studies were published because they placed in the top three in the competition. Other students have had versions of their research published in outlets such as the *Review of Development Economics*, *American Journal of Agricultural Economics*, *Education Economics*, and *Agricultural Economics*. Our experience is that many students have an interest in trying to attain that level if we are willing to continue working with them, and this is where the use of TAs helps immensely. Six different graduate students have served as coauthors on the publications.

Students self-select into the program, so we cannot claim that participation has a causal effect on later academic work. However, 55 percent of the students who participated in the Breakfast Club have gone on to graduate or professional school. Of these, 42 percent have completed a Master's, 7 percent have gone to law school, and 7 percent have gone to doctoral programs.

5 Student Reactions

The Iowa State Alumni Association was able to locate email addresses for about half of the past Breakfast Club members. Many of the students were near the top of their class, but others were C students. We never turned down a student who said they were willing to put in the work. We asked them to respond to the question, "What were the benefits of participating in the Breakfast Club?" We provide some of the replies.

> *"The Saturday Breakfast Club provided a structured time to access professors outside of office hours. It provided access to resources and connectivity to peers. It also fostered accountability. I felt supported and encouraged by my professors."*

"The research program pushed me to look beyond what was in the textbooks and to find ways to apply my in-class knowledge outside of the classroom."

"It provides the opportunity to challenge yourself and pursue a topic or question deeply. When you spend a lot of time on a question or exploring a data set, it opens a lot of different avenues to explore and things to learn. There is also a lot of joy in devoting a lot of time and effort toward a more complicated and extensive task then your typical class assignment. Also, specific to Breakfast Club, you are around other people doing interesting things and challenging themselves."

"The assistance with networking with the other members of the program (great for an introvert like myself!)."

"Having a group-advised setting allowed me to bounce ideas off my peers and provided more oversight to my projects."

"The main benefit was mental. It allowed me to see myself as a capable researcher, and someone who was fit to ask difficult questions and attempt to really find a good solution to the problem or question at hand."

As a sometimes underperforming student, the Breakfast Club gave me an opportunity to engage in the subject I love by using another thing I'm passionate about to keep me focused."

6 Conclusion

The Breakfast Club model provides a low-cost way to increase undergraduate research participation. Minimal new funding is needed, and the benefits of collaboration accrue to faculty, graduate students, and undergraduates alike. Nevertheless, the program would merit expansion by federal agencies interested in encouraging the development of future scholars. The philosophy is similar to that of the National Science Foundation's *Integrative Graduate Education and Research Traineeship* (IGERT) program, which evolved into the *NSF Research Traineeship* (NRT) program. However, those programs are aimed at graduate students and do not build in the interaction between graduate students and undergraduates. It is also comparable in part to the NSF Research Experiences for Undergraduates (REU) program, which partners undergraduates with faculty. A major distinction of the REU, however, is that it only accepts students who apply on a competitive basis and who are U.S. citizens or residents. Crucially, REU participants do not necessarily come from the same institutions.[5] The Breakfast Club model connects undergraduate researchers at a far lower transaction cost.

Our model can effectively target students at the undergraduate level who might otherwise have little exposure to graduate education or to research in general. First-generation college students and students from underrepresented populations are especially well-served by this type of model, which combines research and mentorship attributes. As a policy measure, any funding to support the implementation of the Breakfast Club model should be broad in its research focus to allow promising undergraduates to explore their own curiosity and to learn how to design a project aimed at answering their own questions. Waiting for students to enter graduate programs before engaging in research

[5] The REU accepts proposals from all disciplines, but the expressed goal on the web site is to, "attract a diverse pool of talented students into careers in science and engineering." The weight of the program is heavily in STEM, with sixty-eight in physics, eighty-five in chemistry, but only thirty-three in social, behavioral, and economic sciences, none in economics. There is one in Small Business Innovation Research (https://www.nsf.gov/crssprgm/reu/reu_search.jsp).

ignores the fact that the best prospects for research careers are entering college with many credits in hand and have the skills necessary to experience a challenging research topic as undergraduates.

These are the key lessons that we have derived from ten years of experience running the Breakfast Club.

1. It is critical to have buy-in from advisers who can direct students to the research opportunity. Many promising undergraduates are not thinking that research opportunities are available.
2. It is critical to have buy-in from the faculty as a whole, who may be asked to provide content advising.
3. Most research projects take more than one semester. Students should be targeted early enough in their programs that they can complete a project in three to four semesters, but the program should also be sufficiently flexible to have some one-semester projects.
4. Do not obsess on completion. Students learn from the process. Nevertheless, have an agreement at the beginning on whether the objective is a publishable paper, a completed senior essay or poster presentation, or just progress on a completed research proposal. We adjusted the credits allocated based on the objective.
5. Our program is evolving into a concurrent BS/MS program that provides students more recognition for their research. It may be that the Breakfast Club was a midpoint toward the development of an alternative degree option.
6. The strategy relies on returns to scale. Joint undergraduate projects, team competitions, or other means of exploiting returns to scale are critical to maximizing the benefits from the fixed faculty and graduate student inputs.

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Acknowledgments: We are grateful for partial research support under USDA-NIFA grant 2018-68006-27639 and a grant from the Charles Koch Foundation. Methods and data collection were reviewed by the Institutional Review Board at Iowa State University (IRB Study 23-233-00). The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper. This research was supported [in part] by the U.S. Department of Agriculture, Economic Research Service. The findings and conclusions in this publication are those of the author(s) and should not be construed to represent any official USDA or U.S. Government determination or policy.

Appendix A: Breakfast Club Student Publications

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DOI: https://doi.org/10.71162/aetr.319006

Teaching and Educational Methods

Mandatory Undergraduate Research: Unlocking the Potential of Students at a Latin American University

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JEL Codes: A22, I23, A00
Keywords: Career readiness, higher education, Latin America, Zamorano

Abstract
Through undergraduate research experiences (UREs), students develop important knowledge and skills, such as reading and understanding scientific literature, working independently, and communication skills. The acquired knowledge and skills apply to their professional life, regardless of whether students pursue a career in science. Because students choose to participate in these experiences, the overall satisfaction and perceived benefits of the experiences tend to be positively evaluated. The URE is a graduation requirement at the Panamerican Agricultural School (Zamorano University). To the best of our knowledge, no literature explores student satisfaction and perceived benefits in the context of mandatory UREs. In this teaching method article, we present details on the URE at Zamorano University, including its modalities, procedure, and required human and capital resources, student satisfaction, and perceived benefits for the 2023 agribusiness cohort, and the overall impact to society. The results suggest most students were satisfied or very satisfied with the experience and perceived moderate to significant benefits. However, mean satisfaction and perceived benefits were lower than non-mandatory UREs at other institutions. Finally, we present evidence of the UREs' contribution to faculty involved in advising and its benefits to society.

1 Introduction

Agrifood systems in Latin America have been recognized as successful for their contribution to feeding a growing population worldwide and their role in facilitating economic development. Nonetheless, significant challenges remain, such as environmental and health costs, rapidly growing urban populations, food insecurity, poverty reduction, and climate resilience (Morris, Sebastian, and Perego 2020). In this context, feeding a growing population while addressing shocks in the agrifood systems and ensuring the availability of resources for future generations is a significant challenge faced by current and future agribusiness professionals. Therefore, the industry demand for professionals in the field is significant, driving higher education institutions to continuously revise and adjust their academic programs (Morales et al. 2023). One tool available to universities to develop problem-solving and critical thinking skills to face the agrifood system's challenges is undergraduate research experiences (UREs).

This paper provides a brief literature review on the concept of UREs, the expected benefits, and the required components to be successful learning experiences. Then, we present the methodology of the URE at the Panamerican Agricultural School in Honduras (hereafter referred to as Zamorano University), including details on its modalities, procedure, estimates of the program's cost, and required human and capital resources. In the last section of the paper, we present data on students' satisfaction and their perceived benefits for the 2023 agribusiness cohort and some of the benefits to society that go beyond the URE itself. Zamorano University's URE is unique and worth discussing for an important reason. Compared to other programs where enrollment is optional, it has been a graduation requirement for all undergraduate majors since 2002.

2 Undergraduate Research Experiences (UREs)

Undergraduate research has long been considered a valuable learning experience for students. It enriches the college experience, prepares students for the industry demands, and can help students make decisions regarding their upcoming professional life. The Council on Undergraduate Research (2024) defines undergraduate research as "A mentored investigation or creative inquiry conducted by undergraduates that seeks to make a scholarly or artistic contribution to knowledge." There are two main approaches to undergraduate research: Course-Based Undergraduate Research Experiences (CUREs) and UREs (Linn et al. 2015; Auchincloss et al. 2017). Broadly explained, CURE refers to any research projects students might complete within the context of a specific course, while URE refers to hands-on experiences where students are immersed in laboratories or research teams and outside the boundaries of specific courses. For the remainder of this paper, we focus only on the second approach, URE. While UREs might be mapped within a study plan for the benefit of students, they can benefit all involved, including faculty members who serve as mentors, the university, and society (Petrella and Jung 2008).

According to Lopatto (2009), students who participate in undergraduate research can develop skills that enhance their cognition, behavior, and attitudes, enabling them to address challenges and foster self-confidence and independence. At a deeper level, students develop interaction and communication skills (including leadership and teamwork), data collection and interpretation skills, reading and understanding primary literature, responsibility, knowledge synthesis, and computer skills. From another perspective, Seymour et al. (2004) defined seven benefits of undergraduate research, including increased confidence in a personal and professional capacity, learning to think and work as a scientist, improved overall skills, clarification or refinement of career path, a changing attitude toward the value of learning and working as a researcher, and other benefits such as a good summer job or access to laboratory equipment and learning to manipulate it.

Since UREs have many potential benefits, it is important to determine what makes them successful. Five essential features of undergraduate research have been described by an inquiry into faculty from several universities. For a successful URE, students should: (1) be prepared by reading relevant literature, (2) have the support of a mentor or learning community, (3) have the opportunity to design research, (4) have the opportunity to work independently, and (5) have an opportunity to communicate their work (Lopatto 2003).

3 The Undergraduate Research Experience at Zamorano University

Zamorano University is an American international boarding school in Honduras focusing on tropical agriculture. As of 2024, its student body was composed of representatives of 17 Latin American countries. The university offers four undergraduate majors: agronomy, food science, environmental sciences, and agribusiness. A strong component of the instruction at the university is the learning-by-doing methodology, in which students in its undergraduate programs devote half their time to learning-by-doing modules. All undergraduate majors last four years, with each year consisting of three academic periods of 15 weeks each. All undergraduate students must complete an URE and an internship during their senior year as graduation requirements.

The official name of Zamorano University's URE is Special Graduation Project, which consists of two learning spaces, each during the last two academic periods of the degree study plan. Each learning space is equivalent to a 15-week course, with three academic credits each. At the end of both academic periods, students receive a pass/fail grade. Each student is assigned a primary advisor from the department where they are pursuing their major and must have at least one secondary advisor. The secondary advisor can be a faculty member from the same academic department, another department, or a practitioner as long as this person holds a master's degree and has topic-specific knowledge and

experience. Finally, students must choose one of three modalities for their URE: (1) research study, (2) project, and (3) products.

3.1 Modalities

The URE at Zamorano University has three modalities students might choose: research study, project, and products. In the research study modality, students are expected to directly apply the scientific method, collect data, and test one or more research hypotheses. Students choosing this modality usually belong to more technical majors, such as agronomy or food science, where they get direct access to research facilities, such as laboratory or production units within the university.

The project modality is designed for students with innovation and entrepreneurship inclinations who may want to start their own business after graduation or expand the family business. Students are expected to develop a technical and business plan for their projects in this modality. Because the business plan is a key component of this modality, it is more prevalent among agribusiness students than students from other majors.

In the product modality, students are not expected to apply the scientific method but to develop academic literature products, such as case studies, manuals, and literature reviews. Case studies and manuals are usually designed with the collaboration of the industry from previously established faculty professional networks.

3.2 Procedure

With minor variations in the execution, Table 1 shows the general pathway all students must follow to complete the URE. As a general timeline, students must complete steps 1 through 5 by the fall semester of their junior year, step 6 by the spring semester of their senior year, and steps 7 and 8 by the summer semester of their senior year. Students who complete their research projects early can move forward with steps 7 and 8 during the spring semester of their senior year. While the URE at Zamorano University mandates that all students write a technical report, data from Lopatto (2009) suggests that around 52 percent of students participating in UREs give a talk on campus, 46 percent write a paper to be read by a mentor, and 4 to 5 percent write a manuscript intended for a technical report of a student scientific journal.

3.3 Required Resources

Making every student go through the URE requires an important investment in faculty time, physical resources, and logistics. The following sections outline the human resources, budgetary, and physical resources historically used to facilitate this mandatory URE.

3.3.1 Human Resources

In each academic department, the staff required for the URE program consists of one URE Coordinator, all faculty in the department as every faculty member is required to mentor UREs, and administrative support staff. A professor in the Agribusiness Management Department at Zamorano University can expect to advise between five and eight students each year. The URE Coordinator is expected to spend three hours per student, the primary advisor 20 hours, and the secondary advisor five hours. On average, a single student would require 28 hours of faculty time throughout the entire URE. To provide some perspective, data from Lopatto (2009) suggests that mean weekly contact hours between students and faculty can be as low as 5.8 (SD = 2.9) in engineering and as high as 11.5 (SD = 10.2) in biology. For 2024, the senior group of students in the agribusiness major is 44, translating into an estimated 1,232 hours or 154 business days. Assuming a nominal faculty salary rate of US$ 145/day, the program has an estimated cost of US$ 507.5 per student and US$ 22,330 for the 2024 agribusiness cohort, just in human resources.

Table 1: Steps Involved in the Development of the Undergraduate Research Experience at Zamorano University

No.	Step	Description
1	Introduction to the URE	Details on the URE are presented to students by a faculty member who serves the role of URE Coordinator.
2	Assignment of primary advisor	Based on students' interests and faculty availability, students are assigned a primary advisor.
3	Agreement on the topic and secondary advisors	Students meet with the primary advisor, who helps them translate their interests and ideas into something doable within the time frame and with the available resources. At this point, secondary advisors are suggested and invited to participate.
4	Writing of a research plan	Students work on their own to develop a research plan. This plan must have an introduction, a literature review, and a methodology. During this step, the students might meet several times with their advisors. These advising sessions vary based on the students' needs but usually last between 30 and 60 minutes.
5	Plan approved/rejected	Only the students' advisors can approve the research plan. Hence, the research plan gets worked on until the advisors are satisfied and approve the students to move on to the next step.
6	Development of the plan	With a research plan approved, students take on data collection and analysis. In this stage, students work closely with the professor and their teams. In some specific cases, the URE may be developed outside [Latin American University], in which data collection requires additional efforts from faculty and other collaborators to ensure the student has the experience to collect data in the field.
7	Final paper writing	Students write their final paper after data collection and analysis, including results, discussion, and conclusions. During this step, students might meet several times with their advisors until the final paper is approved.
8	Presentation	All students must make a 15- to 20-minute public presentation of their paper, followed by 10 to 15 minutes of questions by a review committee.

3.3.2 Budget and Physical Resources

Due to the diversity of topics to be addressed during the URE, the required physical and economic resources greatly vary. Every student gets a budget of approximately US$ 150, which they may or may not use. As part of the research plan, students must present a budget, which later helps the URE Coordinator make budget decisions and allocate more than US$ 150 to other students if necessary and possible. Once again, using the 2024 agribusiness senior cohort as an example, the total cost in terms of budget is US$ 6,600. For the agribusiness major students, this budget is usually allocated to travel expenses (visiting local communities, supermarkets, and field visits), production inputs (seeds, fertilizers, and irrigation), and exhibition displays.

Beyond the budget, students get access to all facilities at Zamorano University as long as activities are appropriately coordinated with the personnel in charge. For example, a student in the agribusiness department testing the technical efficiency of a new feed additive for tilapia (*Oreochromis niloticus*) would have access to the aquaculture pools to conduct their research trials at no charge but would have to purchase the fish and the feed from its budget plus any additional costs, and take on all the labor required for the experiment. This is possible because all facilities at Zamorano University serve multiple purposes, including production for sale, learning-by-doing, training (extension), and research.

Many research projects occur in partnership with local farmers, cooperatives, and processing plants. In those cases, the student takes advantage of the partner's facilities and conducts experiments and trials in situ. When this is the case, the cost of the URE is covered by the entity requesting the project. Also, before the COVID-19 pandemic, many students did internships before the URE, with many of those internships taking place at universities and research centers. During these internships, it was common for the students to get involved in research. As long as they fulfill all the URE requirements and the supervisor at the receiving institution agrees, students can present the fieldwork as part of their URE.

4 Programmatic Impact

In this section, we present the impact on students, measured as student satisfaction and their perceived benefits, as well as the impact on society, measured as scientific contributions.

4.1 Impact on Students

Since the 2024 cohort was still in the URE at the writing of this paper, we present data on the 2023 senior cohort of agribusiness undergraduate students. The 2023 cohort consisted of 52 students, of which 62 percent completed a survey evaluating their satisfaction with the URE, perceived benefits, and plans after graduation. No treatment for no response was conducted. The original survey instrument consisted of five sections to gain insight into the research experience and was adapted from the Survey of Undergraduate Research Experiences (SURE) developed by Lopatto (2004). However, we only present results relevant to this paper and make the complete survey available in Appendix 1 for those institutions seeking a deeper insight into their programs. Before completing the survey, students were provided with a consent statement in which they needed to agree to participate in the study. No identifiable data was collected.

4.2 Student Satisfaction

Overall satisfaction was evaluated with the question: What is your overall level of satisfaction? Students answered on a five-point Likert scale (1 = very unsatisfied, 2 = somewhat unsatisfied, 3 = neutral, 4 = somewhat satisfied, and 5 = very satisfied), plus a prefer not to answer option. The mean and median overall satisfaction of the 2023 cohort were 3.84 and 4, respectively (SD = 1.08). Most students (59.4 percent) have some level of satisfaction with the URE, 28.1 percent were neither satisfied nor dissatisfied, and roughly one in ten were somewhat dissatisfied. The overall satisfaction was lower than the value reported by Lopatto (2004), in which the mean satisfaction with the URE was 4.21. A one-sample t-test suggests that the mean found at Zamorano University is statistically different from the one reported by Lopatto ($t = 20.1161$, $p < 0.001$). Lopatto's study collected data on 1,135 undergraduates from 41 universities and colleges participating in summer undergraduate research programs.

4.3 Perceived Benefits

The average perceived benefit (mean of the 19 statements) was 3.375 (SD = 0.5424) for all responses, with 40 and 49 percent of the responses as moderate to significant perceived benefits across the 19 statements. The overall mean of the 19 statements (3.375) was lower than that of the 3.72 reported by

Lopatto (2004). A one-sample t-test suggests these means are statistically different ($t = -12.5569$, $p < 0.001$).

At Zamorano University, the top three items for which students perceived the most benefit were: (1) understanding the research process in the discipline (M = 3.53, SD = .57), (2) skills analyzing data and information (M = 3.50, SD = .62), and (3) learning to work independently (M = 3.48; SD = .62). The three items for which the students reported the less perceived benefit were: (1) understanding how researchers think (M = 3.25; SD = .80), (2) becoming part of a learning community (M = 3.23; SD = .84), and (3) clarification of professional path (M = 3.13; SD =.66; Figure 1).

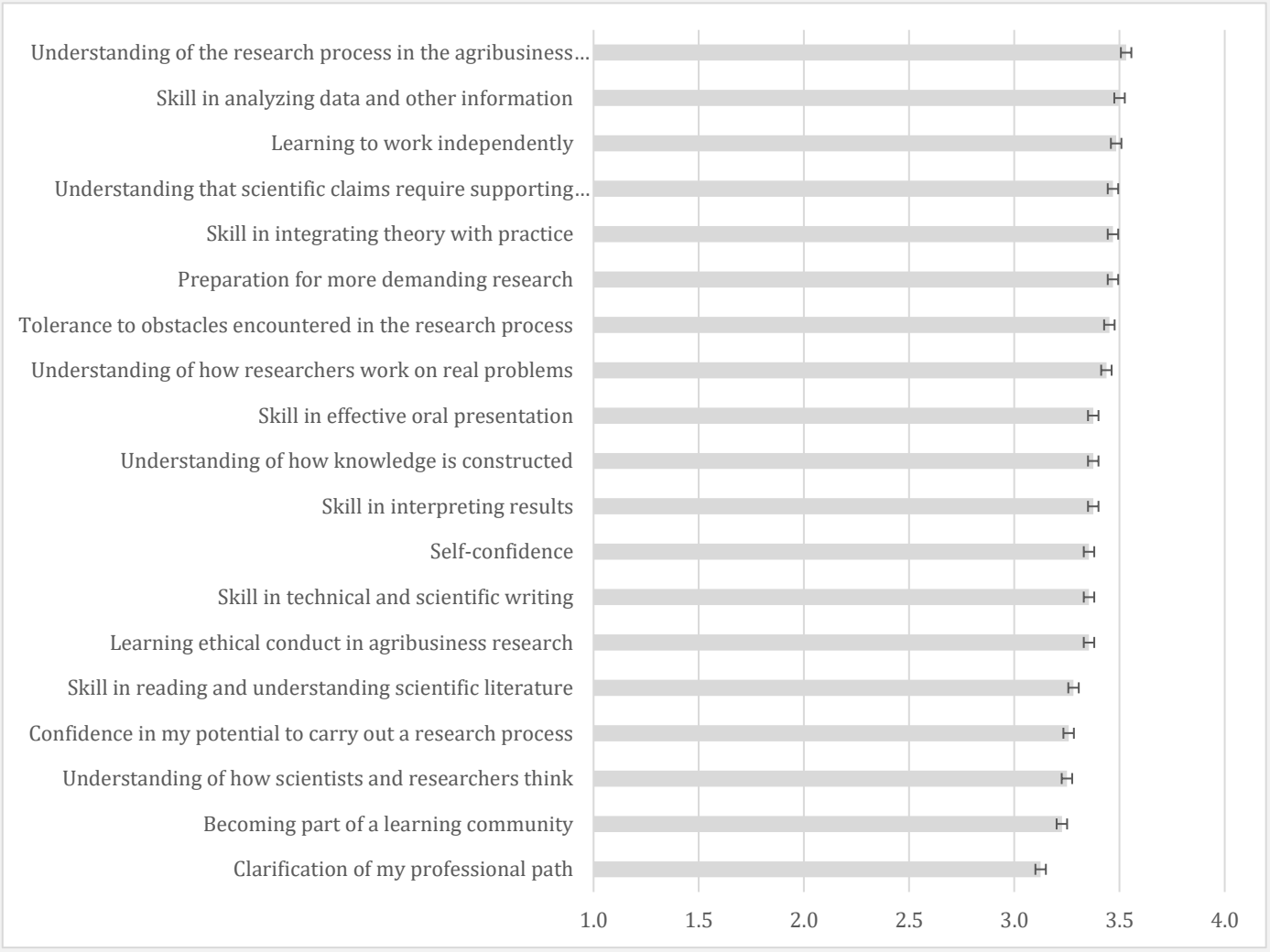

Figure 1: Mean Perceived Benefits by Students of the UREs.

Notes: Likert-scale items with the following scale: 1 = no gain at all, 2 = some gain, 3 = moderate gain, 4 = significant gain, N/A = rather not answer/does not apply. Standard errors for 95 percent confidence interval of the mean.

4.4 Impact on Society and the Agricultural Sciences

The last step of the URE is when students deliver their research report to the university library. Per Zamorano University policy, all URE reports are publicly available through the university library website (biblioteca.zamorano.edu) with an Attribution-NonCommercial-NoDerivs Creative Commons license (CC BY-NC-ND). Additionally, all URE reports are indexed in the Food and Agriculture Organization's International System for Agricultural Science and Technology (AGRIS) and can be found via popular

search engines such as Google Scholar. As a point of reference, from 2021 to 2023, Zamorano University graduated an average of 345 undergraduates each year and made more than 900 URE reports publicly available, with an estimated 18 percent prepared by agribusiness major students during that timeframe. It is important to note that these technical reports are the work of undergraduate students, with intellectual contributions from the faculty, but that has not gone through peer review.

Many faculty at the university are active researchers who motivate their students to continue their URE work and submit it to annual meetings or scientific journals. While this is not the norm and not mandatory, there are successful cases where agribusiness students have presented at the annual meeting of the Agricultural and Applied Economics Association, the annual meeting of International Agricultural Education and Extension, and published in Zamorano University's Scientific Journal Ceiba (Sandoval, Zapata, and Lemus 2021; Santillan and Sandoval 2021; Zacarias et al. 2021; Rodriguez and Sandoval 2023; Sandoval et al. 2023; Morales and Pérez 2024; Patt, Rendon, and Morales 2024). By our best estimate, between 5 and 10 percent of all UREs in the agribusiness program at Zamorano University reach conference proceedings or journal articles each year. This estimate is low compared to student self-reported communication and dissemination activities, where 28 percent of students report presenting a poster at a conference, 20 percent writing a manuscript for a professional journal (not peer-reviewed), 13 percent making an oral presentation at a conference, and 4 percent writing a manuscript and a student scientific journal (Lopatto 2009). Finally, while we cannot infer causality, UREs can be used to motivate talented students to pursue graduate degrees. In our sample, 37.5 percent of students reported having an interest in continuing to graduate school immediately after finishing their undergraduate degree, which is higher than the 22.5 percent reported by Lopatto (2009).

5 Conclusions

The primary objective of Zamorano University's URE program is to develop a set of research-related skills in the students, including the ability to read and understand scientific literature, collect and analyze data, independence, and verbal and oral communication skills. These skills also prepare students to better confront the agrifood systems challenges they will face once entering the workforce or pursuing graduate school. Students completing the URE and reaching the stage of presenting their project have been deemed acceptable by the primary and secondary advisors, suggesting that the learning objectives intended were fulfilled. It is worth noting that since the URE is part of the academic program and students pay for it in their tuition, all associated costs are accounted for, including faculty time. Therefore, similar programs should be implemented with properly assigned resources, especially faculty time.

Overall satisfaction and perceived benefits of the 2023 agribusiness cohort were positive. Most students were very satisfied with the experience and perceived moderate to very significant benefits. However, the results were lower than those reported for students who voluntarily decided to participate and enroll in UREs. This suggests that students who opt to participate in UREs may have higher satisfaction and perceived benefits than students who see the URE as another graduation requirement and have no research interests. Students who decided to participate in UREs likely have an inclination toward research or intentions to pursue a graduate degree and, therefore, view the entire experience as beneficial to their professional and career aspirations, rating their satisfaction and perceived benefits higher.

Since the URE intends to develop student skills, the communication of the results is built within the experience, and the number of projects that reach conference proceedings and journal articles is low. At Zamorano University, it is up to the professor to motivate their students to continue their work and prepare it for conference proceedings or scientific journals. Considering that Zamorano University is a primary teaching institution, this requires additional effort by faculty. While Zamorano University offers graduate programs in agribusiness, these are professional degrees with non-thesis requirements. Hence,

faculty with established research lines usually use the URE to advance their research. It is recommended that primary teaching institutions incorporate UREs to provide faculty with opportunities to foster research and build their research agenda. It is unlikely that individual UREs will produce high-quality research, but if adequately managed, they can produce exploratory studies and preliminary results, and build over-time publishable material.

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Acknowledgements: In Honduras, no established regulatory requirement exists for Institutional Review Board (IRB) approval for research involving human subjects. However, it is essential to emphasize that both researchers involved in this study have received formal training in human research ethics and have diligently undertaken all necessary precautions and ethical considerations to safeguard the well-being and rights of the participating students. The researchers have conducted this study with the utmost commitment to ethical standards and the principles of informed consent, confidentiality, and respect for the participants' autonomy, ensuring their protection throughout the research process. The study was also approved by the department´s head and the academic dean.

Appendix 1. Survey Questions

Section 1: Students Perceived Overall Experience

Item	Statement
1	The research experience was more stressful when I did not have research hours assigned to my schedule.[1]
2	The university and the department should respect the research hours assigned and not ask for mandatory activities during those hours.[1]
3	While conducting my research, it was difficult to balance my other academic responsibilities.[1]
4	While conducting my research, it was difficult to get enough time with my advisor to discuss my research.[1]
5	While conducting my research, it was easy to plan and schedule my research activities.[1]
6	Overall, I find doing a research project more interesting than doing assignments and other academic activities.[1]
7	I learned more from my other academic activities than from my research experience.[1]
8	Regarding the expectations before starting the research experience, how difficult was it to conduct research?[2]

Notes. [1] Likert-scale items with the following scale: 1 = strongly agree, 2 = agree, 3 = disagree, 4 = completely disagree, and 5 =rather not answer/does not apply.
[2] Multiple-choice items with the following options: 1 = the experience was significantly less difficult than expected, 2 = the experience was less difficult than expected, 3 = the experience was as difficult as I expected it to be, 4 = the experience was easier than expected, 5 = the experience was significantly easier than expected, and 6 = rather not answer/does not apply.

Section 2: Students Perceived Benefits

Item	Statement[1]
1	Clarification of my professional path.
2	Skill in interpreting results.
3	Tolerance to obstacles encountered in the research process.
4	Preparation for more demanding research.
5	Preparation for more demanding research.
6	Understanding of how knowledge is constructed.
7	Understanding of the research process in the agribusiness discipline.
8	Skill in integrating theory with practice.
9	Understanding of how researchers work on real problems.
10	Understanding that scientific claims require supporting evidence.
11	Skill in analyzing data and other information.
12	Learning ethical conduct in agribusiness research.
13	Skill in reading and understanding scientific literature.
14	Skill in effective oral presentation.
15	Skill in technical and scientific writing.
16	Self-confidence.
17	Understanding of how scientists and researchers think.
18	Learning to work independently.
19	Becoming part of a learning community.
20	Confidence in my potential to carry out a research process.

Notes. [1] Likert-scale items with the following scale: 1 = no gain at all, 2 = some gain, 3 = moderate gain, 4 = significant gain, and 5 =rather not answer/does not apply.

Section 3: Alignment with Essential Features of Undergraduate Research (Internal Assessment of the Methodology)		
Essential Feature of Research	**Student Survey Instrument**	**Faculty Rubrics**
Students should be prepared by reading relevant literature	N/A	Document rubric,[3] Criterion No. 2. Introduction, literature review, problem statement, and research objective
Support of mentor	1. Think about the person who was your main advisor.[1] 2. Think about the person who was your secondary advisor, if you had more than one, choose the person most relevant to your research.[1]	N/A
Opportunity to design research	N/A	Document rubric,[3] criterion No. 3, Methodological design
Experience working independently	1. Library tools for students[2] 2. Reference style workshop[2] 3. Research databases available at library[2] 4. Logistical support from the department[2]	Document rubric,[3] criterion No. 6, Knowledge and technical ability
Opportunity for communication	N/A	Overall grade of the oral presentation rubric[3]

Note.
[1] Multiple-choice items with the following options: 1 = my mentor was not a good professor or mentor, 2 = I feel my mentor was below average as a professor or mentor, 3 = I feel my mentor was an average professor or mentor, 4 = I feel my mentor was above average as a professor or mentor, 5 = I feel my mentor was an outstanding professor or mentor, and 6 = rather not answer/does not apply.
[2] Likert-scale items with the following scale: 1 = very useful, 2 = useful, 3 = of little use, 4 = nothing useful, and 5 =rather not answer/does not apply.
[3] Assigned grades by faculty ranging from 0 to 100 points.

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DOI: https://doi.org/10.71162/aetr.469385

Teaching and Educational Methods

Service-Learning in Agricultural Economics: Harnessing Local Food to Introduce Students to Applied Research and Extension

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JEL Codes: A22, A23, Q13, Q16
Keywords: Experiential learning, Extension, service-learning, undergraduate research

Abstract
Despite the benefits resulting from experiential, active, and problem-based course design, most economics classes still rely on "chalk and talk." Economics departments have been slow to develop accessible, course-based experiential learning opportunities such as undergraduate research, and even fewer incorporate service-learning projects. These activities provide an opportunity for students to apply economic concepts to their communities. However, the few service-learning based economics courses discussed in the literature do not include collaboration with departments of Extension, despite the clear synergistic possibilities.

This paper describes a project-based service-learning course where student undergraduate teams, with a master's student team leader, serve as consultants to address an organizational or business problem faced by a local agrifood operation. Using economic tools and primary data collection and analysis, teams develop a marketing plan that provides actionable recommendations, including a presentation to the client. Students enjoyed the course, demonstrated improvements in conducting research and survey design, and by the end of the course, students were more knowledgeable about Extension and had positive perceptions of its impacts. While there are benefits to departments of agricultural economics or agribusiness developing these types of courses, they also require additional effort on the part of both the instructor and the students.

1 Introduction

The benefit to society of applied economics research is predicated on economists' ability to translate academic findings into digestible information that is relevant to producers, consumers, and other stakeholders. While Cooperative Extension programming is a prime example, the Extension system is facing a crossroads as long-term personnel are retiring, and it is important that new hires represent the increasingly diverse communities in which they serve (Grotta and McGrath 2013; King 2018; Anigma and Stokes 2019; Taylor and Zhang 2019). However, many undergraduate students, even those at land-grant universities, are unfamiliar with the existence and mission of Extension (Grotta and McGrath 2013; Ebner et al. 2017; Henley, Herceg, and O'Grady 2018; Mott, Lorenz, and Britt-Rankin 2021). Experiential learning activities, including internships and research projects, could offer a crucial mechanism to educate students on the role of Extension in communities and its potential as a career (Grotta and McGrath 2013; Sellers et al. 2020; Mott et al. 2021).

Experiential learning fits well into the Extension mission of community engagement and can improve students' ability to work independently and in teams, manage their time, ask questions and listen to stakeholders, and communicate with diverse and non-academic audiences (Ebner et al. 2017; Anigma and Gaebel 2018; Johnson et al. 2019; Sellers et al. 2020). These projects also benefit the local community and provide students the opportunity to apply their academic knowledge to the real world (Johnson et al. 2019; Sellers et al. 2020). In this paper, I describe an experiential, project-based service-

learning course designed to introduce students to survey research, market planning, and Extension and outreach.

Successful Extension personnel must not only be good communicators but also be willing to listen to stakeholders to understand their needs (Taylor and Zhang 2019; Evans and Bohman 2022). While opportunities such as the AAEA Graduate Student Extension Competition are available to train economists in Extension, there need to be more opportunities for exposure, especially among undergraduate students (Taylor and Zhang 2019; Shear 2020). These activities could also potentially address the lack of diversity in the discipline. While women have played an important role as agricultural economists in government positions, they are underrepresented in associate and full economic faculty positions with Extension appointments (Evans and Bohman 2022; Hilsenroth et al. 2022). Additionally, less than 5 percent of these positions are held by non-white economists (Hilsenroth et al. 2022). In order to increase interest in pursuing Extension as a career, faculty must begin recruiting and mentoring undergraduate students from a variety of backgrounds (Taylor and Zhang 2019), including designing research-based classes that are open to more than just the top honors students.

Agricultural courses have long relied on project-based learning, though this pedagogy is much less common within the field of agricultural economics (Smith and Rayfield 2016). In project-based learning, students take an active role in designing and evaluating projects that have real-world implications (Shih and Tsai 2017). Students in courses implementing project-based learning will find themselves developing competencies in teamwork, critical thinking, and interpersonal communication, often within an interdisciplinary framework, and these classrooms are associated with increased academic performance and peer interactions (Shih and Tsai 2017). Additionally, students in courses that incorporated academic research felt that it prepared them for their future careers and improved their research and presentation abilities (Kemp 2019).

One particular form of project-based learning, the service-learning project, has the ability to help economics students achieve economic mastery while also providing an introduction to Extension activities at land-grant universities. A service-learning course allows students to apply economic knowledge and tools to local, community problems in a way that can lead to enhanced conceptual understanding and increased student motivation (Hervani and Helms 2004; Ziegert and McGoldrick 2008). Students conducting service-learning projects have improved academic achievement and achieve deeper learning, including a better understanding of economic theory and increased analytical thinking skills (Hervani and Helms 2004; Ziegert and McGoldrick 2008). Service-learning also allows students to explore paradigms beyond self-interested utility and profit maximization by encouraging students to view economic tools as a way to improve communities and achieve pro-social outcomes (Ziegert and McGoldrick 2008).

This paper describes a new service-learning course that was taught in the Department of Agricultural and Resource Economics at the University of Connecticut in Spring 2022 and 2023. Student groups worked with an agrifood client throughout the semester to assess their needs and develop a marketing plan to address their strategic goals. As part of this project, the groups designed and disseminated a survey, the results of which were expected to inform their final recommendations. In the remainder of the paper, I describe the course, detail benefits and pitfalls, and provide a descriptive assessment of the student experience. This type of course could be implemented in any applied economics program to introduce students to working with community stakeholders and conducting independent research with real-world applications.

2 Teaching in Economics

Most economics instructors still primarily use traditional lecture methods in their courses, despite the increasing adoption of active learning and discussion activities in other disciplines (Becker and Watts 2001; Watts and Becker 2008; Picault 2019). This is concerning as methods such as cooperative and

small group learning have been shown to lead to improved academic outcomes for economics students, including increased peer interactions (Yamarik 2007). Given the high cognitive load faced by economics students, active learning activities, flipped classrooms, and undergraduate-led research are methods to more efficiently teach economic concepts, but they are not currently being implemented in most courses (Ziegert and McGoldrick 2008; Hultberg and Calonge 2017; Henderson 2016; Henderson 2018; Mendez-Carbajo and Davis-Kahl 2019). These educational practices have been shown to be especially beneficial for underrepresented students (Nagda et al. 1998; Ishiyama 2002; Russell, Hancock, and McCullough 2007). Thus, within economics education, there is clear room for growth in creative course design.

Additionally, while programs need to prepare students for the tasks they will be undertaking in the workforce, traditional academic research may not sufficiently incorporate the types of activities they will encounter in their jobs (Kemp 2019). Employers highly value "soft" skills such as creativity, communication, critical thinking, and teamwork (Boland and Akridge 2006; Noel and Qenani 2013; Gillespie and Bampasidou 2018; Feuz and Norwood 2019). Within these categories, specifically sought after competencies include active listening, concise and clear oral communication, and non-academic writing (Crawford et al. 2011), and McGoldrick (2008) found that economics departments with increased writing activities had students who demonstrated increased skills gains. However, economics students do relatively little writing in their coursework (Hervani and Helms 2004), and most employers felt graduates in agriculture and natural resources lacked the ability to communicate with lay audiences (Crawford et al. 2011). Project-based group work could address some of these skill gaps.

Employers value problem-solving skills, especially the ability to break an ambiguous concept into analyzable components, and expertise in collecting and analyzing data using Excel or statistical software, but current programs may not sufficiently cover these topics (Boland and Akridge 2006; Crawford et al. 2011; Gillespie and Bampasidou 2018; Jenkins and Lane 2019). Employers also increasingly seek ethical employees with cultural or gender awareness, which are also topics missing from many economics curricula (Boland and Akridge 2006; Crawford et al. 2011; Gillespie and Bampasidou 2018). An economics course that emphasizes lay communication, data analysis, and ethical considerations within an inclusive framework and team-based environment would address many of these concerns.

While undergraduate research experience is associated with positive student outcomes, these projects are often reserved for top students in economics departments, even though average or typical students may especially benefit from these activities (Henderson 2016; Henderson 2018). Additionally, undergraduate research opportunities are still not being systematically implemented in economics programs (Siegfried et al. 1991; McGoldrick 2008). An alternative approach is to integrate independent research into an upper-level or capstone course, which increases access to these experiences and exposes students to academic or Extension jobs within agricultural economics.

3 Course Development

Siegfried et al. (1991) notes that the primary goal of an economics program should be that students learn to "think like an economist," and Hansen (1986, 2001) laid out six key competencies necessary to achieve this aim, which move from lower order to higher order proficiencies:

1. *Access existing knowledge*. This could range from the ability to locate data to accessing information on significant economic topics.
2. *Display command of existing knowledge*. This takes students one step further by expecting them to summarize and explain their economic topic or be able to describe an economic concept.
3. *Interpret existing knowledge*. Students must now be able to evaluate how economic concepts are used to explain or analyze specific topics or issues.
4. *Interpret and manipulate economic data*. Students should be able to explain relationships between distinct data points and interpret analytical results.

5. *Apply existing knowledge*. This competency entails students creating an academic report that analyzes a problem using economic concepts and data, or writing policy briefs on an economic issue.
6. *Create new knowledge*. Students ready to graduate should be able to perform their own research studies, and explain the problem, methodology, and results through a final academic paper.

Thus, higher-level courses should be taught in such a way that students leave having achieved objectives four, five, and six, and there are concerns that graduates have not attained these skills (Hansen 2001; Henderson 2016; Henderson 2018). While these competencies prioritize academic over lay communication, they also converge with many of the talents sought by future employers.

In developing the course, I considered Henderson (2016)'s suggestion that experiential learning activities in economics should be student-led, involve the community, incorporate group work, and be outcome-driven. Additionally, Siegfried (2001) notes that a good economics research project should require students to select their own topic and problem, develop a methodological approach, conduct and interpret a data analysis, and use both oral and written communication to explain their work. The course was designed for upper-division students who had already completed microeconomics and the department's Computational Analysis[1] course, which covers hypothesis testing and linear regression, in order to ensure students would be capable of analyzing the survey data they collect. The course was cross-listed in both the undergraduate and graduate program, and groups of undergraduate students, with a graduate student leader, worked collaboratively with a client throughout the semester.

Identifying and enlisting agrifood clients can be tricky as they should have a need or problem that is actionable and can be addressed by students within a fourteen-week period. They must also be willing to engage with the students. They are asked to attend the class at least twice, once to introduce the organization and problem, and again at the end during the final presentations. They also respond to group questions throughout the semester, sent to them by the instructor over email, and may help facilitate survey implementation. While a flyer advertising the class to agribusinesses was created to be shared during Extension farming workshops, recruiting generally occurred through informal networks. The most recent client, a food systems nonprofit, became involved after the director and instructor met during an unrelated initiative. Clients are secured before the start of the semester so that upon the first day students have an idea about the problem they will be asked to address. While this course has all student groups work with the same client, to reduce coordination issues and ensure the client receives multiple solutions to select from, it would be feasible to work with a variety of entities.

Students begin the semester by discussing the client problem and engaging in an exercise of writing initial ideas on post-it notes, allowing us to identify clusters of interest. Preliminary groups are then created based on interest and responses to a short instrument assessing research, data, and communication skills to ensure balanced competencies across groups. In the second week, students participate in a brainstorming session with their groups, including the development of key questions. At the end of the second week, the client visits the class to discuss their business problem in more detail with students, including the results they hope to see by the end of the semester. After this meeting, groups of three to four undergraduate students, with a graduate student leader, are then finalized based on proposed approaches. Thus, groups are formalized going into the third week of classes, and the majority of remaining classwork and assessments revolve around these groups. Students have total flexibility in crafting their solutions, and must consider the needs of the client and results from both primary and secondary data analyses. One constant across projects is that students must develop a

[1] *Computational Analysis in Applied Economics* is a three-credit course where students learn fundamental concepts of statistics and economics through analysis of economic data using Excel. Topics include calculating and interpreting one and two population summary statistics, data visualization through charts and figures, analysis of variance, correlation, and regression analysis.

strategy around the marketing mix "4P's," including specifics on product development or modification, a pricing analysis, a promotional strategy and a discussion of sales channels.

While groups work separately, and develop their own unique solution, they do share updates with each other to receive feedback. They also collaborate on survey design as they have the same target audience, and coordinating implementation increases the overall sample size, though this is not strictly necessary and could be difficult if there were multiple clients. Each group develops a set of proposed survey questions, and then as a class, we go through them to edit for clarity and debate their inclusion, considering tradeoffs between gaining additional information and overburdening respondents. This requires students to consider the value of each question, and what kind of role it would play in their final analysis. Students conduct power analyses to determine an optimal sample size and then are each responsible for attaining a given number to achieve that overall sample size; targets are generally in the range of 200 responses.

As observed in Table 1, the course objectives primarily address higher-level Hansen proficiencies. The first required deliverable is a situational analysis and secondary data exercise, which requires students to both *access* and *display command of their existing knowledge*. For the food systems nonprofit, groups utilized industry databases, data from a stakeholder survey conducted by the organization, and internal documents to analyze their client through Strength, Weaknesses, Opportunities and Threats (SWOT) (Weihrich 1982), Political, Economic, Social, Technological, Legal, Environmental (PESTLE) (Rahman 2023), and Porter's (Porter 1979) frameworks. Survey development is based on results from the situational analysis and client discussions, demonstrating students' ability to *interpret and apply* secondary data to an economic question. The survey implementation strategy is dependent on the client and their needs. For the food systems nonprofit, the survey was distributed through their listserv and at the local cooperative grocery store, as well as at a community farm day event. Students are expected to analyze their survey results, including *interpreting the data* so that it can be used in their final solutions. They are then expected to *apply the knowledge* gained from their primary and secondary data analyses, and the competencies developed in prior courses, to address their client's problem. This culminates in

Table 1: Relationship Between Course Objectives and Hansen Proficiencies.

By the end of this course you, the student, should be able to …	Hansen Proficiency
Design a survey for primary data research in the food industry	*Access existing knowledge; display command of existing knowledge; and interpret existing knowledge*
Assess survey data using a variety of statistical techniques	*Interpret and manipulate economic data*
Apply marketing plan best practices to a unique problem faced by a local stakeholder in the food industry	*Apply existing knowledge*
Develop a clearly designed client deliverable that makes actionable recommendations supported by sound economic research and principles	*Create new knowledge*
Graduate students will additionally be able to successfully lead a project team, including facilitating interpersonal interactions and achieving goals and deliverables	

creating new knowledge through a final marketing plan and presentation for the client. For the food systems nonprofit, each group used the results of their situational analysis, consumer survey, and discussions with the client to develop a new value-added food product using excess gleaned produce. While the student groups achieved the client's goal in their final product development, the solutions differed in the actual food item, packaging, labeling, promotion strategy, pricing, and logo redesign.

A key component of service-learning projects are structured reflections that require students to actively make connections between their coursework and community activities, improving their ability to transfer knowledge between various contexts (Hervani and Helms 2004; Ziegert and McGoldrick 2008). Following Henderson (2018), students complete project management reports as their primary reflection component. These biweekly submissions require each group to reflect on six project areas: their understanding of the client's business and needs, project goals and objectives using the Specific, Measurable, Achievable, Relevant, Time-bound (SMART) framework, a project timeline with both short- and long-term deliverables, a discussion of progress toward their goals (including missed deadlines and corrective actions taken), an analysis of the relationship between the project and course material, and an assessment of the capabilities of each team member (including competencies the group needs to improve upon).

At the start of the semester, I discuss with students the importance of these reflections, and include language in the syllabus explaining their purpose. However, beyond its use as a reflection, these reports also benefit teams by forcing them to set clear deadlines and ensuring all team members are on the same page, and students are encouraged to use a backward planning philosophy when establishing their timeline. These reports are especially useful in the first part of the course as students are still developing as a group. It also gives the instructor insight into the students' thought process beyond in-class conversations, and allows for formative feedback to be provided throughout the semester. Additionally, by considering the needs of their client each week, students must engage in collaborative, stakeholder-led work, requiring the ability to both listen and translate what they hear to understanding.

Students are not required to have taken any business courses, and given the semester time frame of fourteen weeks, the course can occur at a faster pace than students may be used to. Each week, students complete a module covering both market research and survey design concurrently. Examples of marketing topics include the 4P's, market segmentation, situational analysis (SWOT, PESTLE, Porter's 5 Forces), and strategic planning. Concurrently, students are also learning about secondary data sources and analysis, survey question design, sampling methods, survey dissemination, and communication best practices. Though a week is spent discussing survey data results, they are expected to have sufficient data analysis abilities through their Computational Analysis prerequisite. There are three primary homework assignments that constitute deliverables in progression toward the final plan. The first consists of a situational analysis, which requires the use of secondary data in addition to industry and academic resources. In the second, students submit a draft of their survey, including an explanation for the inclusion and design of each question. For the third, students create promotional material and present their proposed designs before the class to receive formative feedback. The final deliverable, which constitutes 40 percent of their grade, is a written marketing plan and a presentation of their plan before the client. To reduce stress for students, I incorporate the use of reverse outlines (Henderson 2016) for academic articles, provide reading guides for denser texts, and devote time in each class period for groups to meet among themselves and with me. While in final evaluations, 60 percent of students reported spending only one to three hours per week outside of class preparing for the course; the final 40 percent was evenly split between four and six hours or ten or more.[2]

[2] One potential explanation for this time discrepancy is that graduate students have supplementary assignments and reading that take extra time. However, this class also requires a large commitment from students due to the group activities, survey dissemination, and high expectations for client deliverables. In line with Henderson (2016), I do explain this to students on the first day of class to prepare them.

I also incorporate a module on land-grant institutions and Extension, with several purposes. First, I introduce students to the Extension system, including specific programs in the state that are targeted toward the small agribusinesses focused on in this course, and invite an Extension educator to meet with the class. This provides students with additional information on the resources that may be available to their client. As part of this module, we also discuss anti-racist approaches to outreach, including the importance of listening to stakeholders rather than imposing their preconceived ideas or worldview. This allows students to connect their project work with Diversity, Equity, Inclusion (DEI) initiatives on campus and in the state while also reminding them to consider the needs and preferences of their client. This was especially relevant for the food systems nonprofit, as students were tasked with creating a value-added product from gleaned produce that would be sold through the local cooperative, and whose profits would be used to fund the purchase of culturally appropriate food for their food pantry. Second, Extension programs are inexorably tied to land-grant institutions, and many undergraduate students are not familiar with the land-grant system or aware they are attending one. Through readings and videos, they learn about the Morrill and Smith-Lever Acts, including current Extension programming. However, to provide students with a clear picture of both the success and ramifications of the land-grant system, they also engage with the interactive Land Grab CT website[3] (a local extension to Land Grab U[4]). This provides additional context on the community responsibilities of land-grant universities and Extension programs, and complements the philosophy of service-learning.

Graduate students that take the course are expected to serve as group leaders, including coordinating workload, facilitating communication, and maintaining team morale. To aid them in this role, they receive additional instruction in leadership competencies. This includes modules on providing candid feedback, leadership and communication style, effective communication, active listening, and managing team dynamics. Graduate students begin with a module on teaming, which recognizes the difficulty of managing groups and building teamwork in short-term environments when participants do not have pre-existing relationships. Each week, they reflect on the dynamics within their own groups through a discussion board dedicated to the graduate students, and they provide comments and feedback on each others' reflections. I also participate on these discussion boards to provide additional support and suggestions. While each homework assignment is completed as a group, the graduate student leaders also have a supplemental assignment that requires higher-level economic and econometric analysis. For instance, while the group promotional assignment consists of creating new promotional material and explaining the design and messaging choices, graduate students must additionally devise metrics to measure the success of their promotional activities and describe how evaluation datasets would be structured and analyzed.

4 Descriptive Outcomes

Both students and the clients appear to have benefitted from their collaboration in this course.[5] In evaluations, students noted they valued that the course emphasized real-world applications and experiential learning. Students also appreciated the creativity of the project, with one writing that "I love when there isn't just one way to do something, it made me feel like I could focus on what I really wanted to do."

Students were asked to complete a short survey before and after the course, and below I present results for the ten students that completed both instruments. While the small sample size does not allow for any tests of statistical significance, there are some general trends. Students were first asked their perception of their skills in a variety of competencies (Table 2), as well as their use of key research databases (Table 3). While students reported improvements in most areas, they were especially

[3] https://www.landgrabct.org/
[4] https://www.landgrabu.org/
[5] Client satisfaction was based on conversations during and after the course. However, implementing a short evaluation form for clients could have provided additional insight into their experience.

Table 2: Students Rating Themselves Very Strong or Somewhat Stronger than Average.

How would you rate yourself on the following competencies…	Pre	Post
Data Management/Handling	2	6
Statistical Data Analysis	2	5
Conducting Research	2	7
Survey Design	3	9
Survey Data Analysis	1	7
Project Management	6	7
Time Management	6	8
Teamwork	9	9
Leadership Abilities	7	7
Interpersonal Skills	8	9
Problem Solving	6	9
Applying Course Material to Real-Life Problems	4	6
Writing Academic/Research Papers	6	7
Writing for a Lay/Business Audience	2	5
Oral Communication/Public Speaking	5	5
Excel	6	8
PowerPoint	4	8
Canva	4	6
Social Media	6	8

Note: Students rated themselves on a six-point scale. "Somewhat stronger than average" and "Very strong" correspond to the two highest points.
Ten students completed both pre- and post-assessments across the two semesters.

Table 3: Students Reporting Using Research Databases

Have used the following resource…	Pre	Post
Ibisworld	0	4
Mintel	0	3
Statista	5	6
Abi/Inform	0	3
Agricola	1	7
Google Scholar	8	9

Note: Ten students completed both pre- and post-assessments across the two semesters.

prominent in survey design and analysis, conducting research, data management, and use of PowerPoint. In contrast to the perceptions of employers (Crawford et al. 2011), most students rated themselves highly in teamwork, leadership ability, and oral communication at both the start and end of the course. They also demonstrated an increased use of databases such as IBISWorld, Agricola, and Mintel.

As seen in Table 4, despite attending the University of Connecticut, only three of the ten students were familiar with the concept of a land-grant university, while by the end of the semester only two could not name a land-grant (the most commonly offered example now being the University of Connecticut). Similarly, at the end of the course, most of the students were able to explain how land-grant universities are funded (including mentions of the Morrill Act and Native land theft) and what Extension personnel do.

Table 4: Students Correctly Answering Knowledge Questions		
Question Text	**Pre**	**Post**
Do you know what a land-grant university is?	3	8
Provide an example of a land-grant university.	3	8
How are land-grant universities funded?	1	7
Have you heard of the Cooperative Extension system?	3	9
Have you interacted with Cooperative Extension agents/personnel?	2	7
What do Cooperative Extension agents do?	3	7
What is the relationship between Cooperative Extension and the land-grant system?	2	6

Note: Ten students completed both pre- and post-assessments across the two semesters.

Table 5 compares student perceptions of Extension at the start and end of the course. By the end of the semester, students were more likely to agree that Cooperative Extension improves quality of life, is a trustworthy source of information, and is relevant to most New Englanders. However, the course does not appear to have impacted student interest in pursuing a career in Extension.

Table 5: Student Perceptions of Extension		
How much do you agree with the following statements…	**Pre**	**Post**
Extension is relevant to my life	3	4
Extension is relevant to the lives of other members of my family	3	5
Extension is relevant to most New Englanders	2	6
A career in Extension would be appealing to me	4	4
Extension is a trustworthy source of information	4	6
Extension improves the quality of life of those who use its services	3	8

Note: Ten students completed both pre- and post-assessments across the two semesters.

5 Conclusion

To continue attracting a diverse student population, economics programs need to better incorporate active learning activities into their curriculum. Service-learning courses integrating research and stakeholder engagement can encourage students to achieve higher-order economic competencies while providing exposure to problem-solving, teamwork, and communication. In this paper, I detailed an example of a project-based course where students collaborated with a client to develop a marketing plan for their operation. In line with best practices, the course allowed students to take the lead on project design, required them to analyze and interpret data they collected, incorporated small teams, and encouraged engagement with the local community. Student deliverables included both a written marketing plan and client presentation, providing experience with both written and oral communication.

There are several course design elements I found particularly useful. Each homework assignment was a core component of the final deliverable, which kept students on track and allowed for formative feedback. However, I learned students needed specific details for these assignments to provide clarity on how to approach each deliverable. For instance, for the literature review assignment, I provided a minimum number of articles to include, suggested a combination of academic and business sources, and invited the college librarian to class to provide an overview of available databases. The project management reports proved to be an effective mechanism to track team progress, and the reflections were especially important early in the semester when group dynamics were still being established and most project details were undecided. The leadership modules gave the graduate students confidence and

actionable recommendations for group management, and these could even be incorporated for undergraduates.

Overall, the course appears to have been a success. Students enjoyed the class, including their ability to work with a real client and direct their own learning. Their self-assessments demonstrated improvements in conducting research, survey design, and data management and use of research databases. The course also included a module dedicated to the land-grant system and Cooperative Extension, and by the end of the course, students were more knowledgeable about Extension and had positive perceptions of its impacts. While the course increased student awareness of Extension, and their attitudes toward programming, it did not impact their career interest. This could be because the course placed students in the role of consultant, with Extension acting as a service to be utilized, rather than emphasizing career opportunities within Extension. This could serve as an area of further development.

The biggest challenge in teaching this course is maintaining student engagement throughout the semester as they grapple with the large amount of coursework. A key facilitation strategy was to devote at least half of each class period to group work, which allows the instructor to recognize challenges regarding group dynamics, support students as they work through project ideas, and answer questions as they arise. Students were not required to have taken an introductory business management or marketing course, as those topics are covered in their weekly modules, but such a requirement could have reduced the metacognitive burden for students who were learning marketing principles concurrently with survey methods. Course design needs to carefully consider tradeoffs between requiring classes or competencies that exclude students and managing the amount of content the course must cover. Additionally, the course does take more instructor time than traditional classes, primarily around recruiting clients and managing relationships. Thus, while there are benefits to departments of agricultural economics or agribusiness developing these types of courses, they also require additional effort on the part of both the instructor and the students.

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Acknowledgments: There are no funding sources to report. The study was declared Not Human Subjects Research by the University of Connecticut Institutional Review Board. I have no conflicts of interest to report.

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DOI: https://doi.org/10.71162/aetr.288697

Teaching and Educational Methods

Expanding Undergraduate Research Experience: Opportunities, Challenges, and Lessons for the Future

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JEL Codes: A22, C30, O13, Q10, Y20
Keywords: Dta analysis, diversity, equity, inclusion, internships, teaching

Abstract
Research is a core activity at universities, but the largest group of people at most universities—the undergraduate students—frequently graduate without scientific research experience. In this case study, we highlight challenges to engage undergraduates in the research process and focus on three key issues: student interest, timing, and access. We then report on our experience of preparing and rolling-out a research internship program designed to overcome these three hurdles. We target: (1) students not interested in a career in research, (2) lower-division students with little to no classroom research experience, and (3) students who are underrepresented in economics and/or STEM based on their race/ethnicity or gender identity. We candidly discuss the benefits, costs, hurdles, constraints, and successes of the program's first cohort and make recommendations for others interested in curating similar programs at their own institutions.

Introduction

Research is the foundation of universities, providing the structure of the institutions and the status of their reputation, with rankings based on research productivity and grantsmanship. But research is an experience not typically afforded to the largest group of people at universities: undergraduate students. In fact, participation in research rarely extends beyond faculty and graduate students. Many undergraduate students are entirely unaware of the important role research plays within the university structure.

Undergraduate research experiences have a positive impact on the participating students, as well as faculty (Linn et al. 2015; Wagner 2015; Feyrer 2017; Hoyt and McGoldrick 2017). Despite these benefits, both faculty and students face challenges in creating and engaging in authentic research experiences for a multitude of reasons. Three such challenges are: student interest, timing, and access. First, many career-oriented students may eschew research experiences, as they feel there is limited applicability to their intended non-academic career objectives. Students may not realize that the applications of the skills learned doing research are extensive and valued on the job market (Petrella and Jung 2008; König 2022). Second, research opportunities are often not open to students until their final year at the university, leaving insufficient time for a faculty member to invest efforts in training an individual and integrating them into a research team. Evidence has shown that with the appropriate framing of the research experience, undergraduate students can be trained on the job in research methods and engage in meaningful research activities early in their academic careers (Awong-Taylor et al. 2016; Thiry et al. 2017; Casson et al. 2018). Third, many students lack access to opportunities for engaging in research as many of these opportunities are unpaid. Unpaid undergraduate research internships or assistantships can be exclusionary and may bifurcate students into groups of those who can afford unpaid work and those who cannot, leaving the students in the latter category "behind." Evidence suggests that students from minority groups that are underrepresented in economics and/or STEM are particularly affected by this divergence (Hurtado et al. 2009; Ahmad et al. 2019).

To address the gaps in undergraduate research participation, many universities have pushed to add research training into their undergraduate offerings. These opportunities can be grouped into four categories: courses in empirical research methods, course-based undergraduate research experiences (CUREs), competitive research programs, and external internship experiences. In the context of agricultural and resource economics, empirical research methods courses develop empirical analysis skills and cover topics including econometrics, identification, and regression techniques. CUREs come in many varieties and typically have students practice and perform the steps necessary to complete a targeted research project. Competitive undergraduate research opportunities, such as the Ronald E. McNair Achievement Program, provide mentored undergraduate research experiences where students engage in activities or projects which are conducted by undergraduate students, guided by a faculty member, and confirm or extend existing knowledge or create new knowledge. Finally, external internships connect students with research teams outside the university setting and vary widely in their research methods, required skills, and payment schemes.

While each of these formats delivers research exposure, each presents various shortcomings to many undergraduates. First, research methods courses or seminars typically provide training but lack the decision-making and knowledge generation of self-guided research. They are also commonly elective courses instead of required curricula. Second, CUREs afford accessibility to many students but lack authenticity due to their relatively large class sizes. The number of students served generates a tradeoff: to keep on track, the research design is typically chosen by the course instructor, meaning students make fewer impactful decisions in terms of steering research questions, data practices, or how hypotheses will be tested. Further, both research methods courses and CUREs also require students to pay for credit hours. Third, programs such as McNair Scholars target high-achieving students interested in pursuing doctoral studies. This excludes students interested in going into the job market directly from their undergraduate programs, which represent many undergraduate students. Further, this means that the doors to the mentored undergraduate research experiences offered by the McNair Scholars are closed to all but the most academically excellent students. Finally, external internship experiences present challenges to students who cannot obtain transportation to off-campus research work, cannot afford to perform unpaid research activities, or who do not hold competitive, firm-specific qualifications.

The motivation behind developing the internship described in this paper is to offer learning-based research experiences for undergraduate students. Our approach also aims to engage them in research driven by real-world problems, while addressing the challenges limiting undergraduate involvement in research, which are found in the four most common existing undergraduate research mechanisms. Further, the internship was also motivated by the explicit objective of increasing diversity in applied economics. Economics remains a white and male dominated field. As economists, we are cognizant of the constraints on both students and faculty to build authentic research experiences. These constraints may limit efforts to diversify higher education by excluding interested students in early stages of their academic career, creating a path of dependence that leads them away from academia. With the internship, we hoped to alleviate these constraints by providing paid undergraduate research experiences, with a guided structure for learning, building skills and confidence, throughout the course of a semester. By investing in students and encouraging them to engage in research early in their studies, we hope to make our profession more inclusive and diverse, opening doors to students who might otherwise be excluded from the experience (e.g., Hilsenroth et al. 2021).

In this paper, we document such a mentored undergraduate research experience. We called our approach a Research Internship in Data Analysis and Applied Economics (henceforth “the internship”). This case study describes the design, execution, and lessons learned from a semester-long internship run by a faculty-directed research lab during the Fall 2022 semester. This novel introduction to applied economic research connected University of Arizona undergraduates (“the interns”), an Agricultural and Resource Economics (AREC) Master of Science (MS) student instructor (“the graduate student instructor”), and supervising AREC faculty (“faculty mentors”). The internship combined elements of the

four undergraduate research categories above to address the three challenges of interest, timing, and access.

This paper contributes a novel approach to developing a paid, on-campus internship experience to the agricultural and applied economics teaching literature. In this case study, we reflect on our experience to provide teaching resources, document the roll-out of this new undergraduate research program, demonstrate a targeted approach to delivering meaningful research experiences to underrepresented undergraduates, and evaluate the incentive structures instituted to invite and engage the participating parties. We candidly discuss the benefits, costs, hurdles, constraints, and successes in designing and implementing undergraduate research opportunities targeted to those from groups traditionally underrepresented in economics and/or STEM.

2 Institutional Background

2.1 The Lab

The lab in which the internship took place brings together researchers, thinkers, and learners, to foster a community of study on economic topics in applied international development. The lab is founded on the principles of Open Science and is committed to the practice of replicability, reproducibility, and transparency in all its research.

The lab is a vertically integrated project (VIP) at the university. VIPs are educational approaches that engage students in long-term, large-scale projects, led by faculty, but guided by other students. As such, an important principle of the internship is the VIP's peer-to-peer learning structure, implemented through trial-and-error and self-determination. The internship was structured to follow this tiered learning environment: students rely on one another to build learning. In the internship, they were guided by both graduate student and faculty mentors.

2.2 Hiring

By design, several elements of the internship sought to attract diverse students in terms of race, gender, year in school, and major. First, we wrote the job posting to highlight that the skills learned by conducting research are in demand by firms outside the research community. Second, we did not require any experience in economics or coding. This allowed us to attract students who had not yet taken upper-division courses in econometrics or data analysis. It also allowed us to build interdisciplinary teams with complementary strengths. Third, by paying interns we were able to involve students frequently excluded from unpaid research opportunities due to financial constraints. In the end, students gained experience in data-based research: a valuable skill for those looking to work as a data analyst, economist, or policy researcher after graduation. With these parameters, the objective was to hire six individuals to be divided into two teams of three interns. We envisioned a composition with each team including one experienced coder, one economist, and one "critical thinker." This final person could be from any major, with no coding experience necessary, but should demonstrate critical thinking skills and an interest in learning quickly and broadly.

In hiring, an advertisement was posted on the university's student job site (Handshake) on August 10, 2022. It expired thirteen days later, on August 23, 2022. Interested applicants were asked to provide a statement of interest of less than one page, as well as a resume. In the approximately two weeks in which the ad was posted, we received 130 applications: two from freshman, 11 from sophomores, 27 from juniors, and 90 from seniors. Students from six colleges and more than forty majors applied. Of some note is that we did not capture as many underclassmen as we had hoped. However, no applicants had previous research experience, and very few had experience analyzing data. Based on a review of all applicants, 13 interviews were conducted. Of these thirteen candidates, nine were seniors, three were juniors, and one was a sophomore. Interviews were all the same in format:

fifteen minutes each on Zoom. All students were asked the same set of questions: (1) With the opportunity cost of your time, what appeals to you about this internship over other internships or jobs? And, (2) What is your coding experience, if any? Give us an example of a project you've done.

2.3 Payment and Credit

Students were paid $3,000 during the semester. Due to the nature of the funding, we could not pay students hourly. Instead, they were paid in three lump sum stipends of $1,000 at the end of September, October, and November. Based on university policy, funds were paid directly to their bursar accounts.

Interns were also eligible to enroll for up to three-credits of internship credit, allowing students to use the experience for both financial and academic gains if they chose. Ultimately, three students enrolled in the internship program for credit.

3 Internship Structure

Once hired, undergraduate interns reported to twice-weekly meetings: one lecture with practicum conducted by the graduate student mentor under faculty supervision and one peer-only small-team research meeting. In keeping with the VIP structure, these different meetings facilitated peer engagement among students of various levels of exposure and expertise to research concepts and skills. Specifically, the more advanced graduate students met with the more green undergraduates to provide assistance and guidance based on experience. Then, undergraduate-only, unsupervised small group meetings built on self-determination, problem solving, and persistence skills.

The biweekly meeting structure also allowed us to leverage the approaches of research methods courses and mentored undergraduate research simultaneously. The lecture and practicum curriculum provided an overview of reproducible research, best coding practices, and causal inference following Nick Huntington-Klein's *The Effect* (Huntington-Klein 2022) and included readings and individual problem sets. The goal was to provide interns with an understanding of how applied economics research is conducted. In contrast, the goal of the small-team meetings was to provide structure for interns to engage in applied economic research. This involved each team developing their own research question, analyzing survey data from the World Bank, and translating their findings into a research poster. Throughout the internship, students gained experience in writing their own code for analysis (in either Stata or R) and gained experience in communication.

3.1 Participants

We hired eight students instead of the intended six. Due to personal circumstances, seven of the original eight students completed the internship. Of the hired students, seven were seniors and one was a sophomore. Students came from backgrounds in economics, business, applied economics, information science, environmental science, environmental studies and ecology and evolutionary biology. Five of the eight interns identify as women, and six of the eight identify as a recognized racial/ethnic minority and/or were a non-U.S. citizen/permanent resident.

A small team consisting of one graduate student instructor and three faculty members mentored the eight hired undergraduate interns. The faculty provided various perspectives, research skills, and areas of teaching specialty and included one tenured associate professor, one untenured assistant professor, and one professional-track professor of practice. The graduate student instructor brought data management skills to the internship but had no prior experience instructing a semester-long course.

3.2 Administration

The financial, digital, and physical structure of the internship was based on and expanded from the existing infrastructure of the lab. The faculty mentors and graduate student instructor agreed on a general structure for the internship curriculum before it began, planning out a weekly schedule with

Table 1: Semester Map.

Week Starting	Lectures	Practicum	Group Meeting Topics	Deliverables	Independent Activities	Readings[a]
5-Sep	What is a research-based internship? Introduction to applied economics research, setting internship expectations, sharing learning objectives.	What is Stata? What is a .do-file? What does it mean to code?	No small-group meeting first week. Research teams not yet formed.	Reflection, timesheet, and .do-file.	Write a Stata .do-file to load data from online repository.	Ch. 1
12-Sep	Introduction to research design, generating research questions, and developing hypotheses.	Introduction to COVID-19 data set and structure of data.	Creation of groups based on overlapping interests and complementary skills.	Reflection, timesheet, and list of five research topics.	Generate a list of research questions, topics, etc., that pique your interest ahead of group meeting.	Ch. 2
19-Sep	Describing variables quantitatively and qualitatively.	Introduction to GitHub and research transparency.	Choose research topic as a group. Set a working directory in Stata code.	Reflection, timesheet, setup GitHub site with pulls and pushes, and .stpr Stata project manager file.	Pull a branch in GitHub. Push a commit in GitHub. Create a Stata project manager workspace to organize files. Calculate the mean of a variable.	Ch. 3
26-Sep	Describing relationships between variables.	Generating new variables and creating graphs in Stata.	Establish small group meeting times, spell out small group objectives, etc.	Reflection, timesheet, and two Stata visualizations of COVID-19 data variables of interest.	Generate new variables using COVID-19 data. Identify related variables and choose a graph to visualize this relationship.	Ch. 4
3-Oct	Introduction to causal identification.	Means over sub-groups. Tests for differences in mean.	Examine differences in variables of interest	Reflection, timesheet, 10 hypotheses, # of t-tests with descriptions, and .do-file.	Do work assigned by group	Ch. 5
10-Oct	Causal diagrams and basic linear regression.	Running and interpreting a regression	Regress outcome on variables of interest.	Reflection, timesheet, regression output, and causal diagram with explanation.	Do work assigned by group	Chs. 6 & 13
17-Oct	Drawing causal diagrams to model cause and effect relationships between variables.	Including covariates in linear regression.	Examine how regression results change with addition of covariates.	Reflection, timesheet, and written critique of peer causal diagrams from previous week.	Do work assigned by group	Ch. 7

Table 1 continued.

Week Starting	Lectures	Practicum	Group Meeting Topics	Deliverables	Independent Activities	Readings[a]
24-Oct	Causal paths and closing back doors to bolster model identification.	Estimating fixed effect (FE) regression models.	Run FE regressions.	Reflection, timesheet, and updated causal diagram of research question related to COVID-19 data.	Do work assigned by group	Chs. 8 & 16
31-Oct	Finding front doors to bolster model identification.	Estimating an event study model.	Run event study regressions.	Reflection, timesheet, short essay explaining your research question as regression equation with explanation of variables.	Do work assigned by group	Chs. 9 & 17
7-Nov	Treatment effects models.	Estimating a Difference-In-Differences (DID) model.	Run DID regressions.	Reflection, timesheet, and .do-file translating previous week's regression into code.	Do work assigned by group	Chs. 10 & 18
14-Nov	Sharing research group status update on research question modeling.	Office hours for coding and debugging	Settle on estimation approach for team poster.	Reflection, timesheet, and updated .do-file with revised regression strategy.	Do work assigned by group	
21-Nov	Question and answer session to address coding and modeling challenges.	Office hours for coding and debugging	Create tables and figures of results for team poster.	Reflection and timesheet.	Do work assigned by group	
28-Nov	Final updates and questions to prepare final submission of posters.	Office hours for coding and debugging	Produce team poster.	Reflection and timesheet.	Do work assigned by group	
5-Dec	Submission of final posters.	Office hours for coding and debugging		Reflection timesheet and final poster.	Do work assigned by group	

[a]Huntington-Klein, N. 2022. The Effect: An Introduction to Research Design and Causality. New York: Chapman & Hall.

topics and deliverables (see Table 1). They also built out the GitHub repository students would use to post their code and created a shared Google Drive to share materials and host internal content. Following the team communication style of the Lab, a Slack channel was launched to allow speedy communications

and addressing of questions among all participants.

The faculty mentors and lab graduate students downloaded and organized the data set, which would be used by the interns for their research project. By providing a data set, we hoped interns would be able to focus on their research question and project, rather than on cleaning data. The data set included data from five countries in Sub-Saharan Africa: Burkina Faso, Ethiopia, Malawi, Nigeria, and Uganda, collected monthly from May 2020 through June 2021. The data were collected as part of the World Bank's High-Frequency Phone Surveys on COVID-19. The data addressed many topics, including COVID-19 behaviors, as well as agriculture, health, food security, income, and more. More detail on the data is available in Josephson, Kilic, and Michler (2021).

The graduate student instructor managed the course content delivered to students and designed the deliverables due at the end of each week. Each week, the graduate student instructor and at least one faculty mentor met to check in and plan lessons. This structure allowed the graduate student instructor to receive feedback about lecture and practicum design and delivery before each full group meeting. Under the guidance of the faculty mentors, the graduate student instructor was able to receive credit for instruction of a course, a bonus from the structure of this research internship experience design.

The faculty mentors handled many of the course-credit, attendance, and housekeeping tasks as the instructor-of-record for credit-seeking interns. They opened each full group meeting, addressed behavioral concerns, and tackled difficult conversations about attendance and attention. By addressing many of the tasks outside of course content, the faculty mentors provided space for the graduate student instructor to focus on course material and delivery. The presence of faculty members also lent credibility and conveyed a seriousness about the internship's topics. This approach provided documented credit hours to faculty mentors to demonstrate a commitment to student engagement beyond normal course loads for annual review and promotion purposes.

3.3 Learning Objectives and Topics

The internship blended together data management and data cleaning skills developed in the Applied International Development Economics (AIDE) Lab, with causal inference methods introduced in Huntington-Klein (2022) and real-world data from the World Bank's High-Frequency Phone Surveys on COVID-19. Each topic was chosen in collaboration between the faculty advisors and graduate student mentor. Then, lectures led by the graduate student mentor introduced the topics, which leveraged the experience and expertise the MS student gained from previous AIDE-lab projects and served as a connecting tier between the undergraduate interns and faculty members. Specific details and the interconnections between lectures, readings, practicums, and deliverables are presented in Table 1.

The topics followed the following general structure:

1. Learn to use GitHub, file paths, and statistical software.
2. Decide on a general research topic and specific research question, forming a testable hypothesis.
3. Summarize and create visualizations of variables, based on their research question.
4. Identify target variables and refine research questions, based on learning and data curation, as well as the summary and visualization of variables.
5. Learn about and create causal diagrams using directed acyclic graphs (DAGs) and consider their application to specific hypotheses.
6. Infer appropriate regression models from the DAGs for testable hypotheses.
7. Defend research questions and create posters, presenting to the other groups, as well as the graduate student and faculty mentors.
8. Revise and finalize posters for submission as final semester projects and capstone internship products.

To access the learning objectives each week, students were assigned a set of deliverables that corresponded with the previous week's topic. This allowed the students time to work independently, with their peers, and with the graduate student mentor in office hours before submitting work for critique. Deliverables included code files, output logs, visualizations, and short writing assignments, depending on the week. Along with the week's deliverable(s), students provided a time log and a reflection journal. These reflections allowed the faculty adviser to identify issues in understanding, hold individual interns accountable for research team contributions, and open lines of communication directly between the undergraduates and faculty.

The interns had various levels of experience with data management and econometric modeling when they started the internship. To align the knowledge across all interns, while promoting information sharing, the course design was structured to deliver a uniform introduction, including examples, for all students. The interns simultaneously learned about best practices for coding and data analysis while applying them to data collected by the World Bank. As many students were not familiar with coding generally or coding in statistical software, students were first introduced to setting up file paths, loading in data, and interpreting variables through summary statistics and data visualizations. After the first month of the internship, interns had created their own GitHub sites, downloaded and started coding in Stata, and begun producing summary statistics and data visualizations using the World Bank data.

After building these foundational skills, students were given the opportunity to explore the data. After gaining familiarity with the data and considering various research topics, students were next asked to constrain their possible set of research questions based on the data. The graduate student and faculty mentors gave feedback about the suitability and feasibility of the research questions. Within their small groups, students pitched their ideas, and each group voted to adopt a topic and research question. However, the very real, frustrating challenges of conducting applied economic research were also part of the process.

For example, one group of interns (Team 2) united around testing the food insecurity on crop mix during COVID-19 for all five sub-Saharan countries in the World Bank data. However, when they ran crop mix summary statistics by country, they realized there was significant missing data with regards to crop mix (Figure 2). This replicated the challenges of professional research in the internship setting because the students realized that they were limited by the quality and nuances of the data. Under the guidance of the graduate student guidance (who intimately knew the limitations of the data), the students decided to focus on Uganda, the country with the highest-quality, available data.

After the students had coalesced around a research question, they moved on to drawing and refining DAGs and determining the specifics of their research design, in a process modeled on a pre-analysis plan (PAP). This matched with the material drawn from Huntington-Klein (2022) about causal inference and DAGs, blending theory and real data, and illustrating the challenges of doing so.

The DAG portion of the internship pushed the students to blend modeling decisions with the constraints of the World Bank data. First, each student independently drew their own DAG to represent their research question. Then, the next week, group members critiqued one another's DAGs and then developed a single, best DAG to carry forward as a team. Given the limited number of covariates and an abundance of confounders, Team 1 concluded that they would pursue a difference-in-differences identification strategy because they could not adequately control for time-varying confounders using the other covered empirical strategies with the data (Figure 1). During this stage, the students in both groups discerned the pros and cons of different models and developed arguments to defend their chosen approaches while acknowledging limitations.

THE UNIVERSITY OF ARIZONA College of Agriculture & Life Sciences

Insight into How Access to Staple Affect Food Security in Pre and Post COVID-19

Introduction

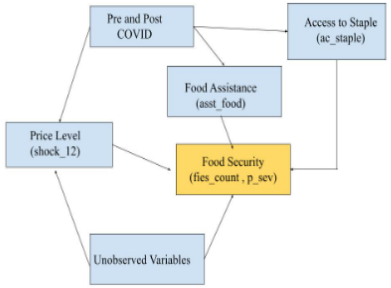
- The COVID-19 pandemic had inescapable impacts on the livelihoods of citizens in developing countries.
- LSMS surveys collected by the world bank across 5 Sub-Saharan Africa in 2019 provide a benchmark for living standards. After the start of the pandemic high frequent phone surveys were implemented following participating households through the pandemic.
- The combined LSMS and high-frequency phone surveys provide a useful panel to compare living standards before and after the pandemic.
- A measure of particular importance is of measures of food security, knowing whether there was a significant change in said standard helps better inform a better understanding of poverty

Model

A difference-in-differences model compares differences in a household's access to a staple crop and food security before and after the pandemic's start. Controlling for non-monetary food assistance and shock in the price level of staple crops.

$$y_{it} = \beta \boldsymbol{x_i} + \partial POST_t + \delta(x_i * POST_t) + z_{it} + v_{it} + \epsilon_{it}$$

- y_{it} Food security outcomes of households over time
- $\boldsymbol{x_i}$ Binary independent variable; measures whether an individual was Unable to access staple crop
- $POST_t$ Binary indicator for determining values either being before or after the start of COVID-19
- z_{it} Binary control asking whether a household has been affected by an increase in the price of a major food item consumed
- v_{it} Binary control asking whether a household had received food assistance



Research Question

Research Question: How did a household's access to a staple crop affect their food security change before and after the start of the pandemic?

Results

At the country level, access to staples significantly worsened food security outcomes before and after the pandemic's start.

The difference in access outcomes after the start was nearly the same, indicating that lower access to staples contributed to lower food security.

Controlling for food assistance and change in the price level, those who lacked access after the start of the pandemic experienced greater food insecurity.

Wanting to deepen our understanding of access related to food security, we expanded the access variable to include more than just one staple crop. The only countries with appropriate data were Ethiopia and Burkina Faso.

Similar model was used with the exclusion price level due to a lack of data.

A new access variable was created by adding the values of three major crop variables households were asked to create a new access score variable

All Countries

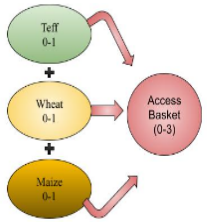
VARIABLES	(1) fies_count
1.post	-2.291***
	(0.133)
1.ac_staple	-2.124***
	(0.146)
0b.post#0b.ac_staple	0
	(0)
0b.post#1o.ac_staple	0
	(0)
1o.post#0b.ac_staple	0
	(0)
1.post#1.ac_staple	-2.095***
	(0.212)
1.shock_12	-5.461***
	(0.115)
1.asst_food	-0.791***
	(0.179)
Constant	11.63***
	(0.0881)
Observations	5,631
R-squared	0.554

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

VARIABLES	(1) fies_count
1.post	1.296
	(1.702)
ac_eth	-0.103
	(0.702)
0b.post#co.ac_eth	0
	(0)
1.post#c.ac_eth	0.532
	(0.738)
1.asst_food	-1.944
	(1.537)
Constant	0.570
	(1.674)
Observations	2,526
Number of hhid	1,223
R-squared	0.012

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Access Refinement



VARIABLES	(1) fies_count
1o.post	-
ac_bf	-1.286***
	(0.392)
1o.post#co.ac_bf	0
	(0)
1o.asst_food	-
Constant	13.70***
	(0.358)
Observations	116
Number of hhid	92
R-squared	0.318

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Discussion and Questions for Future Research

- Results for Ethiopia and Burkina Faso indicate no relationship between access to staples and food security.
- At the regional level ability to access a staple crop significantly increased food security
- Lack of coefficients for the secondary regressions could be due to a lack of data for said countries.
- Further research at the country level could be done to better understand differences across the region.

Acknowledgements

AIDE Lab: Dr. Jeffrey D. Michler, Dr. Anna Josephson, Dr. April Athnos, Lorin Rudin-Rush

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Rudin-Rush, L., Michler, J. D., Josephson, A., & Bloem, J. R. (2022). Food insecurity during the first year of the COVID-19 pandemic in four African countries. *Food Policy*, *111*, 102306. https://doi.org/10.1016/j.foodpol.2022.102306

Figure 1: Final Poster, Created by Intern Group 1.

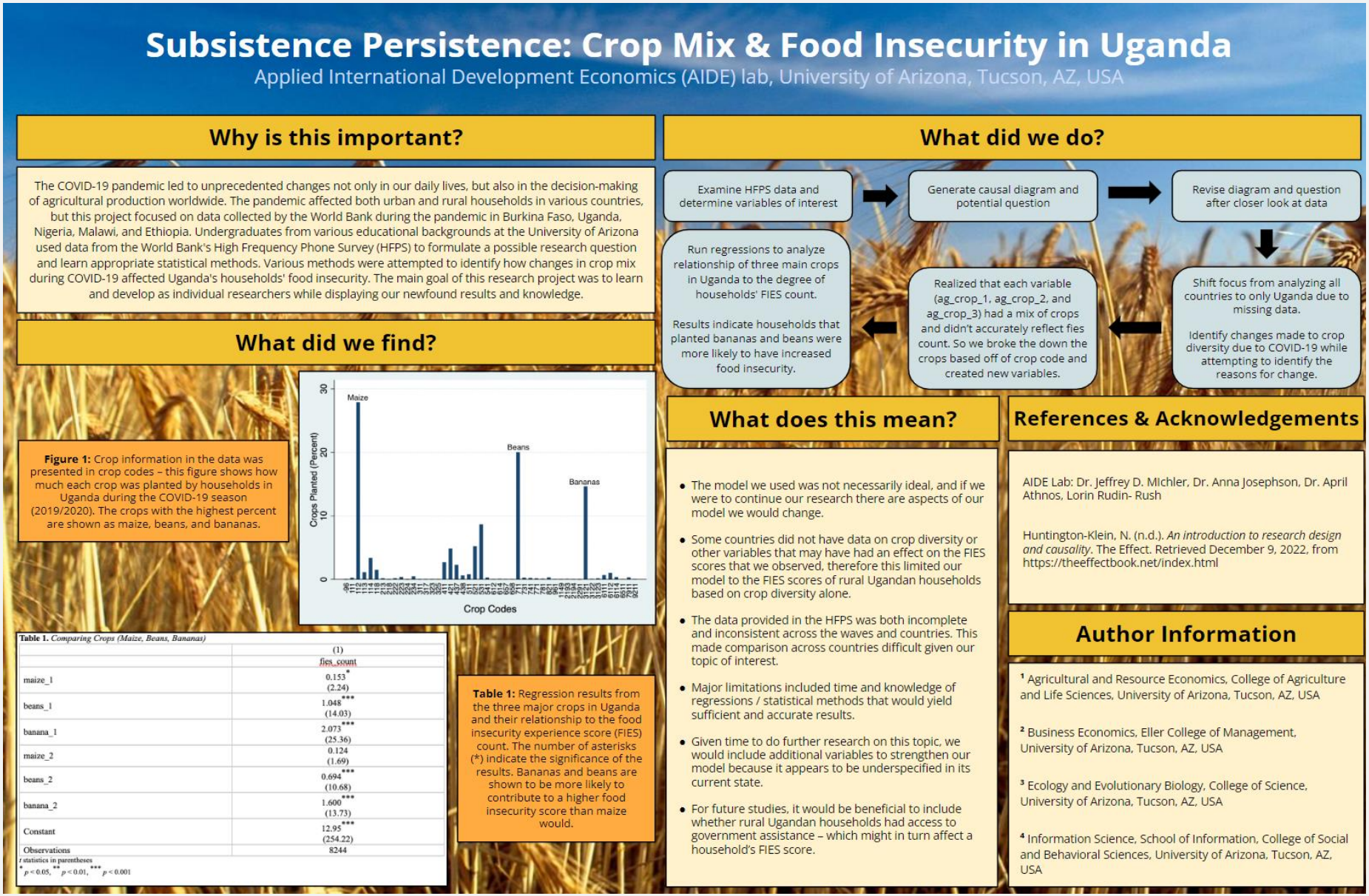

Figure 2: Final Poster, Created by Intern Group 2.

The bulk of the semester included time and space for student groups to work on coding their research design, generating and analyzing regression results, and exploring various methods for displaying and presenting their findings. Both student groups decided to present their results as posters. And so, this culminated in a research poster presentation, done by each group, on the last day of the internship experience. These posters now hang in the AREC department hallway. They are presented in Figure 1 and Figure 2.

3.4 Collaborative Worktimes

The learning objectives and topics were tackled during the mandatory Friday morning meetings that brought together all participants in the internship. This meeting time provided time and space for interaction between all three tiers of the VIP structure: the interns, the graduate student, and faculty mentors. The full group meetings consisted of one hour of lecture in theory, methodology, and best practices followed by one hour of hands-on coding practice, as described above. These meetings were approximately two hours in length.

At the onset of the internship, the interns possessed very different levels of experience with data management and econometric modeling. Every intern received a uniform introduction to the research topics and skills during Friday all-hands meetings, which they acquired and applied at different speeds and levels of confidence. These differences were useful and conducive to learning in a VIP because more experienced and adept students produced positive spillovers to their less experienced peers, and vice versa. During collaborative work times, those with experience were encouraged to share their insights with less-familiar students, reflect on their understanding, and update their approaches. Students encountering the topics and practicing skills for the first time asked questions that tested their graduate student mentor and undergraduate peers, deepening their comprehension. For particularly challenging questions, the faculty members provided a backstop of support for the graduate student.

Beyond Friday meetings, students were also expected to spend about four additional hours a week on internship-related activities to meet the minimum requirements of the stipend. Based on submitted time sheets, students typically spent about six hours each week, with some students spending more time on particularly challenging topics, but students did not systemically report working more than the expectation.

Additional internship worktimes included individual work and peer-only research team meetings. Individually, students received one to two chapters of reading from Huntington-Klein (2022), completed their own set of deliverables, and reflected on their experiences throughout the week and as shown in Figure 1. Collaboratively, students attended peer-only research team meetings to help them accomplish the tasks they were independently responsible for. These small-group meetings allowed interns to discuss their assigned readings, troubleshoot code, and develop their deliverables. During these small-group meetings, students sat with one another, typing and running their own code, throwing similar errors, and experiencing related issues. They grappled with their common challenges, helped one another revise lines of code, and built shared knowledge. The combination of solo and small-group work mimicked the structure of professional research activities that combine delegated tasks with collective decision-making and problem solving.

The weekly research team meetings were scheduled at different times depending on each group member's availability, but they typically took place on Tuesdays or Wednesdays. Additionally, the graduate student mentor offered office hours Wednesdays and Thursdays to support individuals and small groups ahead of Friday's full group meeting and facilitate access to the middle tier of the VIP. The faculty members met with the graduate student weekly and provided on-call additional support as needed.

4 Lessons Learned

As we discussed in the introduction, there are numerous challenges to building undergraduate research internships in which interns engage in research deeply enough to gain an authentic experience of what applied economic research looks like. We designed the Research Internship in Data Analysis and Applied Economics to try and address three specific challenges: student interest, timing, and access. In this section, we candidly assess the success of our attempt to address these challenges, as well as weighing the costs and benefits of our approach. Our aim is to consider how we could, would, and will change the internship moving forward in future semesters as well as provide a roadmap, including bumps and detours, for those looking to engage undergraduates in research.

4.1 Addressing the Three Key Challenges

First, the wording of our job posting generated significant interest. Applicants expressed an interest in learning how to code, analyze data, and formulate research questions so as to contribute to their future employment in industry. While this may have been cheap talk on behalf of students interested in only the stipend, many applicants lacked the skills we sought to foster. Of the interns we hired, only two of the eight mentioned pursuing graduate studies in their personal statement as part of the application. In contrast, at the time of this writing, five interns either enrolled in a graduate program or shared intentions of applying to graduate school. We are unsure if this shift in career interests by the interns should be seen as a success or failure. We would like to think that by offering opportunities to engage in research convinced the interns of the value of a career in research. But it is also possible that the experience convinced students that their undergraduate training was inadequate to make them competitive on the job market without additional schooling.

Second, we did a poor job of attracting students early in their academic career. Among applicants, 90 of the 130 students were seniors. Only two first-years and 11 sophomores applied. Seven of the eight interns we hired were seniors, and we had only one lower-division student. Some of the skewed distribution of class year is structural—lower-division students lack the institutional knowledge of where to find internships on campus, may not realize they could be competitive for the position, and may not understand the value of the opportunity. However, we also believe that by marketing to students in large general education, freshman- and sophomore-level courses during the first week of classes, as well as reaching out to student advisers, a larger, deeper, more diverse applicant pool can be cultivated.

Third, the ability to pay interns largely resolved the issue of access. While we do not have demographic data on the applicant pool, interns are diverse in terms of race/ethnicity as well as gender. From informal discussions with the interns, several interns stated that the only reason they applied and were able to accept the position is that we paid what was effectively more than double the minimum wage. That said, the limited number of hours (six a week) did have a detrimental effect. The family of one student experienced an unexpected loss in income, forcing the intern to quit after one month and take a different job that offered a lower hourly rate but more hours, so that the student could earn more money overall. And again, many applicants and interns who come from populations underrepresented in economic and/or STEM research would be unable to participate in the internship experience if they did not receive financial compensation for their work.

4.2 Unexpected Issues and Recommendations

Beyond the lessons learned in designing an internship experience to address the above challenges, we learned several practical and unexpected lessons. Some of these lessons overlap with methods courses and CUREs, while others resemble the challenges of external internship experiences. While some are idiosyncratic (i.e., unique to our institutional environment), we provide a brief overview of the issues we faced, so as to provide a roadmap of potential bumps and detours for those looking to create similar programs.

First, administrative tasks comprised an unexpectedly large portion of the day-to-day operations of the internships. While some administrative logistics were expected, there were more persistent elements than initially anticipated. Administrative tasks included approving work plans for credit-seeking students, setting clear expectations for attendance and engagement, ensuring timely delivery of intern payments, building the online infrastructure to house data and code, delivering timely communication, preparing lectures and practicum, attending group meetings, reviewing weekly timesheets and reflections, preparing the shared workspace for full group meetings, and establishing distance video communication to accommodate traveling interns. These tasks were divided among the faculty mentors and graduate student instructor based on availability, seniority, and experience. Many of these issues may be one-time "fixed costs" of setting up the internship experience, and so the average cost of running the internships may diminish over time. Additionally, large departments with more in-house administrators than our department may be able to off-load some of these administrative costs, leaving the faculty more time to dedicate to the content of the research internships. Regardless, we underestimated the time required to satisfy administrative tasks and the impact this has on time allocation to other components of the internship, as well as morale of the mentors. We recommend that mentors undertaking such a program prepare themselves for the time of these administrative tasks and ask for help from others, as needed and appropriate.

Second, we believe meeting times and internship attendance expectations should be set *before* hiring interns. We found many of the students who applied for the internship were incredibly busy: overloaded on course credits, working part-time jobs, traveling, and more. Some of this is to be anticipated as students have competing interests on their time. However, syncing and determining a mutually agreeable time for meetings meant the only time that worked for everyone was 8:00 a.m. on Friday mornings. This was a time which, frankly, no one enjoyed. We recommend setting a required attendance period before hiring.

Third, we were surprised that it was necessary to set very formal expectations around attendance. We expected students to treat the internship like a "real job" as one might with any other internship. However, due to the more course-adjacent properties of some meetings, students occasionally were inclined to treat attendance as optional (as they might with a class). We developed a formal attendance policy after the first month with students having to complete timesheets and turn in a short reflection on what they did that week. Because the attendance policy was developed partway through the internship, it was a challenge changing the culture and establishing mutual buy-in with some students. We recommend that any and all expectations about attendance, missing meetings, and additional requirements be established during the first full group meeting and then equally enforced.

Fourth, as with any job or course, resignations and drop-outs happen. After the first month, an intern had a family crisis that required them to leave the internship. Luckily, we had hired eight interns and created two teams of four. The departure of one intern left a team of three students. The three remaining students expressed that they felt at a disadvantage to the other team, having to complete the same amount of work with one fewer member. From the faculty perspective, we felt fortunate that we had hired eight interns instead of the initially planned six. With only six interns, a drop-out would have left a team with just two members—below what we would consider necessary for teamwork to develop in a research setting. We recommend that teams start large enough to address intern attrition without negative impacts on other team members.

Fifth, mistakes happen even when one has worked to reduce their likelihood and created insurance policies to help insulate against them. One of the first activities we do with the interns is to teach them how to use GitHub to version control and preserve their code. Additionally, we teach them that the raw data is immutable and should never be changed or moved. Finally, data is kept on a cloud storage system synced across multiple machines. Despite this effort, one intern, in trying to get the cloud version of the data onto their local machine somehow "unpacked" the folder structure of the data so that the 3,000 plus

data files were no longer in a nested folder structure but all existed together in the main root directory. While the cloud storage system preserves deleted files and the raw files are available in the World Bank Data Library, there was no simple way to rebuild the folder structure and put all of files back into their folders. Folder structure is not something preserved in the cloud storage system's history or version control. Luckily, we had an older, off-line version of the folder structure and so were able to recreate the data structure, but the process still took a week of work on the MS student's part and delayed the progress of the interns' data work. In the future, we will create a copy of the data and place it into a dedicated folder for use by the interns to help ensure their work does not create issues or conflicts with our ongoing research projects. We recommend having offline backups of all resources used by the interns, even in cases where cloud software is used.

Sixth, a single semester is not sufficient time to cover everything related to the teaching and implementation of data analysis and applied economic research. Like any instructor teaching a course for the first time, we overestimated what could be covered and underestimated the time it would take for interns to master concepts such as DAGs for causal modeling or coding syntax. This is especially true if one is trying to involve lower-division students or students who have not previously engaged in research. Ideally, given the outline of the research experience we initially developed, the internship would last a full academic year. But a full-year internship creates its own logistical challenges, including a larger financial commitment, a larger time commitment, scheduling conflicts across two semesters, and higher rates of attrition. Like with teaching a course, this can only be learned through time and implementation, but we recommend that mentors adjust their expectations and cultivate flexibility with themselves and their interns, with respect to achieved learning outcomes.

5 Conclusion

Research is a core activity at universities, but the largest group of people at a university, undergraduate students, frequently complete their degree without ever engaging in authentic scientific research. In this paper, we highlight three challenges often posed as justification for faculty not engaging undergraduates in the research process: student interest, timing, and access. We also discuss the pros and cons of the types of undergraduate research experiences found at many universities. We then report and reflect on designing and rolling-out a research internship program designed to blend extant research approaches to help overcome these three challenges. We candidly discuss the benefits, costs, hurdles, constraints, and successes of the program's first cohort and how that has informed our preparation for a second cohort of interns. We put this forward as a case study for others interested in curating a similar team- and intern-based research experience with undergraduates at their university.

We believe the internship was successful in terms of getting students interested in conducting research and in providing access to those from groups traditionally underrepresented in economics and/or STEM. We had many students who applied, the majority of whom had no plan for graduate school or a career in research. Compensating the interns at above-market rates allowed students to participate who would typically be excluded because of financial constraints. We address unexpected issues with recommendations based on our experience of in curating meaningful engagement opportunities for undergraduate students, particularly underrepresented students. We hope that by sharing our approach and our reflections that our insights and recommendations facilitate the creation of both new and more effective undergraduate research programs in the future.

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Acknowledgments: The authors would like to thank and acknowledge financial support from the Arizona Institute for Resilience (AIR) and Arizona Initiative for Resilience and International Development (AIRID) for undergraduate students and from Dr. George Frisvold and the Bartley T. Cardon Endowment for Agribusiness for graduate student support. The authors would also like to thank the seven research interns for their tremendous work, and particularly Andrew Soderberg, who both participated in the internship and assisted in the application for funding the internships.

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DOI: https://doi.org/10.71162/aetr.369516

Teaching and Educational Method

Integrating Agricultural Research into Undergraduate Work Integrated Learning (WIL) Courses

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JEL Codes: A20, A22
Keywords: Agricultural research, Australia, Bangladesh, Indonesia, undergraduate, and Work Integrated Learning

Abstract
Work Integrated Learning's (WIL) contribution to graduates' career readiness has been widely recognized. WIL programs, from internships and fieldwork to newer formats like hackathons and incubators, allow students to experience authentic work and learning practices. Despite the vast literature on students' WIL experiences and WIL effectiveness, there is a gap in our current understanding of whether and how the research component has been embedded in WIL programs. The industry and workplace-centric nature of many WIL programs, and, in contrast, the perceived relevance of research confined to public and academic domains, often present challenges to developing WIL programs that meet academic and stakeholders' requirements while ensuring student benefits. Therefore, this study showcases the experiences of the University of Queensland (UQ; Australia), Sher-e-Bangla Agricultural University (SAU; Bangladesh), and IPB University (IPB; Indonesia), integrating agriculture-related research into undergraduate WIL programs, all of which highlights the continued importance of university-industry engagement.

1 Introduction

Work Integrated Learning (WIL) has increasingly become one of the key features in many undergraduate programs in developed and developing countries. WIL programs, such as internships and fieldwork to newer formats like hackathons and incubators, are centered around building career readiness, providing opportunities for students to experience authentic work and learning practices. Despite the vast literature on students' WIL experiences and WIL effectiveness, there are multiple gaps in the literature, especially involving WIL programs in agriculture-related fields, including agribusiness and agricultural economics. Agriculture, a pivotal sector for sustainability and economic growth where industry demand for university graduates is high, represents a fertile ground for experiential learning opportunities. In Australia, for instance, the demand for agricultural graduates is at least 3,000 per year, while the number of relevant graduates has been fewer than 900 per year (Pratley 2022). Central to addressing this skill shortage is to ensure industry-ready graduates, hence the importance of WIL.

On the other hand, research is vital in agricultural programs given the industry's need for analytical skills in complex and evolving landscapes. However, integrating WIL and research is not straightforward. WIL is focused on industry and workplace, while research is often confined to public and academic domains. This presents challenges in developing WIL programs that meet academic and stakeholders' requirements while ensuring student benefits. A literature search suggests only a few studies on agriculture-related WIL. For instance, Kassem, Al-Zaidi, and Baessa (2021) examine the efficacy of cooperative education partnerships, considered a type of WIL, and factors impacting these partnerships within tertiary agriculture education. Focusing on Bachelor of Agricultural Sciences students at King

Saud University in Saudi Arabia, the study delves into the influencing factors of cooperative education, including program design quality, students' personal and professional attributes, and the organizational climate. However, the study does not incorporate a research component into its framework. Another study by Wilkes and Flavel (2019) examines students' and academic staff's perceptions of WIL in agriculture at the University of New England, Australia. However, little has been written on the research component of the culture-related WIL program.

The literature review also suggests a lack of research concerning whether and how WIL in agricultural courses has evolved since the COVID-19 pandemic. This is despite the voluminous literature on delivering during the pandemic (Dean and Campbell 2020; Zegwaard, Pretti, and Rowe 2020; Hondonga, Chinengundu, and Maphosa 2022). This issue is critical given the practical nature of many agricultural studies. Furthermore, despite various articles on case studies from WIL in various countries, a conceptual framework to understand the drivers, stakeholders, components, and benefits of WIL in agriculture remains lacking.

Given the above background, this study showcases the integration of agriculture-related research within undergraduate WIL programs at the University of Queensland (UQ; Australia), Sher-e-Bangla Agricultural University (SAU; Bangladesh), and IPB University (IPB; Indonesia). This study highlights the methodologies and outcomes of such integrations, emphasizing the role of university-industry engagement in enriching student learning experiences. Additionally, it seeks to develop and assess a conceptual framework for visualizing how research components are embedded in WIL programs, particularly in agricultural courses, with a forward-looking perspective on potentially improving student outcomes through such integrations. To achieve this goal, first, this study reviews the existing literature on WIL by focusing on research components of the WIL courses before formulating a novel conceptual framework. Second, the framework is then used as a base to conduct a three-country comparison deriving experiences from undergraduate agriculture-related WIL courses offered by the UQ, SAU, and IPB. The three universities are selected given their reputable agricultural programs in those countries and to illustrate different economic and agricultural development stages and educational governance structures.

This article is structured as follows. Section 2 presents a literature review on WIL, focusing on its types and benefits, followed by formulating a novel conceptual framework for integrating research into WIL, in Section 3. Section 4 discusses experiences and insights from WIL courses at UQ, SAU, and IPB, while Section 5 concludes the preceding sections.

2 A Review of WIL

WIL has gained significant attention recently as an innovative educational approach bridging the gap between academic learning and real-world work experiences. WIL integrates academic study with practical, industry-relevant experiences, enhancing students' employability and preparing them for professional roles (Berndtsson, Dahlborg, and Pennbrant 2019; Bowen 2020; Winborg and Hägg 2023). Through WIL, students gain experiences by collaborating with industry or community partners to apply their knowledge and skills within or alongside work contexts (Patrick et al. , 2008).

WIL experiences can take various forms. Jackson and Dean (2023) categorize WIL into three main types:

- **Work-based WIL** (e.g., internships, work placements, practicums, and industry-based projects);
- **Non-workplace WIL** (e.g., classroom or virtual projects, consultancies, simulations, and service learning); and
- **Global WIL** (e.g., industry study tours, international internships or placements, and service-learning engagements).

It is important to note that the definition and practices of WIL may vary across universities and over time. Technological advancement and the COVID-19 pandemic, for instance, have driven adjustments in WIL delivery. Wood, Zegwaard, and Fox-Turnball (2020) identify two types of WIL during COVID-19: remote WIL (online work placements) and simulated WIL (virtual reality and simulations). Alanson et al. (2020) discuss how their institution adapted to COVID-19 by introducing various WIL practices, including remote WIL, simulations, projects, service learning, collaborative labs, and micro placements. Simulations gained popularity during the pandemic for student preparation (Zegwaard et al. 2020). Meanwhile, Andrews and Ramji (2020) transformed the Leading-Edge program into a fully online learning experience, emphasizing the importance of high-quality reflective activities during economic uncertainty.

WIL offers a range of benefits to students, making it a vital component of education, especially at higher education institutions (HEIs) to improve:

- **Students' employability** (Fleming, McLachlan, and Pretti 2018; Jackson and Dean 2023) by providing industry-specific skills and practical experience.
- **Students' professional network** and ability to engage with a wide array of stakeholders (Succi and Canovi 2020). This contributes significantly to the broader spectrum of graduate employability (Peeters et al. 2019).
- **Students' academic understanding** (Ibrahim and Jaafar 2017; Rambe 2018). WIL integrates academic learning with practical experience, reinforcing and deepening students' understanding of theoretical concepts and their applications (Winborg and Hägg 2023).
- **Students' communication, teamwork, and problem-solving skills** (Jackson and Dean 2023).
- **Students' industry relevance** (Smith, Ferns, and Russell 2014; Franco, Silva, and Rodrigues 2019; Navarro, Barbarasa, and Thakkar 2019), which is particularly important given the ever-changing industry requirements.

While much of the literature focuses on the benefits of WIL, a noticeable gap exists concerning the integration of research within WIL. In higher education, achieving a balance between teaching and research has emerged as an important issue (Xia, Caulfield, and Ferns 2015). On one hand, the teaching staff's research experience could enrich students' learning experience through exposure to cutting-edge knowledge and methodologies. However, excessive focus on research can detract teaching staff's time away from teaching preparation and delivery, which could compromise the quality of their teaching and, hence, student experience. Research-oriented teaching is also often criticized for its focus on theories, disconnected from real-world applications. This is particularly an issue for undergraduate teaching that focuses on preparing students' industry-readiness such as WIL programs highlighting the importance of addressing the research-teaching nexus in higher education.

3 Methodology

The objective of this section is to provide a comprehensive and nuanced understanding of how research is embedded in the WIL program in the field of agriculture at three distinct universities. It also assesses the potential impact of these integrations on student learning and engagement. This paper employs a qualitative research methodology to investigate the integration of agriculture-related research into undergraduate WIL programs at these universities. Information was gathered through a content analysis where we reviewed curriculum documents, course syllabi, and relevant program materials to understand the structure and content of their WIL programs. We then developed a conceptual framework to link between WIL in agriculture and research. Using the framework, a comparative analysis was conducted to identify commonalities and differences in key aspects such as curriculum

design, student engagement in research activities as part of the WIL programs, and university-industry collaborations.

4 Integrating Agricultural Research into Undergraduate WIL

This paper seeks to establish a connection between WIL and research activities in agriculture. WIL in agriculture encompasses various activities, such as placements, farm visits (including virtual ones), and engagement with industry. Fleming and Eames (2005) argued that WIL enhances students' research capabilities, as well as their critical thinking, clarity of thought, and time and motion management skills. Research skills such as the ability to analyze literature, work independently, understand scientific studies, leadership skills, and effective communication in conveying research findings are found essential for tertiary graduates (Groat, Gray, and Gray 2010; Hamilton et al. 2016). By integrating research skills with WIL, agricultural graduates can excel in roles such as agricultural research scientists, agronomists, and agricultural consultants. These professionals can conduct research to improve crop yields, develop sustainable farming practices, and provide expert advice to farmers and agribusinesses. Additionally, research skills are valuable for agricultural economists who analyze market trends, assess the economic viability of agricultural projects, and contribute to policy development in the sector.

To teach the research skills necessary for success in this field, this paper has highlighted an approach that focuses on application-centric course delivery. The strategy involves active engagement with industry partners, which is integrated into the curriculum to provide real-world context and relevance. Additionally, the program includes a series of workshops designed to equip students with essential research skills. These workshops complement the industry engagement, ensuring that students not only understand theoretical concepts but also develop the practical competencies required in the field. This combination of application-focused teaching, industry collaboration, and skill-building workshops forms a comprehensive approach to enhancing the educational experience in our courses.

Previous work has addressed this issue of integrating research into teaching practices. For example, Healey (2005) adopts a method to integrate research into teaching practice by "giving students first-hand experience of commercial consultancy (e.g., as an 'intern,' as a work-based learning activity, as a consultant assistant or as a supervised consultant)." The consultancy-type of WIL programs allows students to conduct research activities such as defining the research problem, reviewing the existing reports and information, collecting and analyzing data, and presenting it to industry and academic audiences both written and through a presentation. This engagement also strengthens the connection between academia and industry by fostering innovation and knowledge transfer (Curtis and Mahon 2010). The rationale for emphasizing research within WIL lies in its potential to provide a deeper understanding of complex industry challenges and contribute to sustainable solutions. This is highlighted by Ferguson (2011) through a creative collaboration involving educators, industry partners, and students.

Integrating agricultural research into WIL courses requires collaboration between educational institutions and industry partners and the development of integrated learning models that combine theory with practical research opportunities. This capability is essential for disseminating knowledge and driving innovation in agribusiness sectors. Despite its importance, there is a paucity of literature on integrating research into WIL programs. Recognizing that there have been gaps in the integration of agricultural research in WIL courses, a few studies have suggested ways to integrate them better, as follows:

1. **Develop sustainable partnerships**: WIL programs rely on developing sustainable partnerships between educational institutions and industry partners (Kassem et al. 2021). This is done to establish and undertake important research that can have a significant impact and benefit industrial clients, providing practical solutions based on what students have learned at university.

2. **Design integrated learning models**: WIL provides an opportunity to integrate practical applications in the form of learning models, for instance, integrating agroecology and sustainable food systems theory with practical agricultural research (Ahmed et al. 2017).
3. **Focus on specific areas**: WIL programs can focus on areas such as international agricultural development, food systems, food security, sustainability, and animal science, which can help students develop skills in these areas (Zickafoose and Wingenbach 2023). This is to align research topics with industry needs.

However, the means to achieve the above strategies and the experiences of HEIs in delivering WIL programs that include a research component remain unclear.

To this end, this study develops a novel conceptual framework (Figure 1), the Work Integrated Learning-Research (WIL-R) framework. This framework adopts at least three frameworks: (i) the Linking Research and Teaching–Work Integrated Learning (LRT-WIL) framework developed by Xia et al. (2015); (ii) the Researcher Development Framework (RDF) by Vitae (2011); and (iii) the Theory of Change, which describes how change is expected to occur from program output to outcome and impact. It consists of the following aspects.

- **Drivers** – The WIL-R framework illustrates the various external drivers that can influence the design and delivery of WIL programs, including at the industry and macroeconomic levels, and drivers that are more directly related to research support and partnerships.

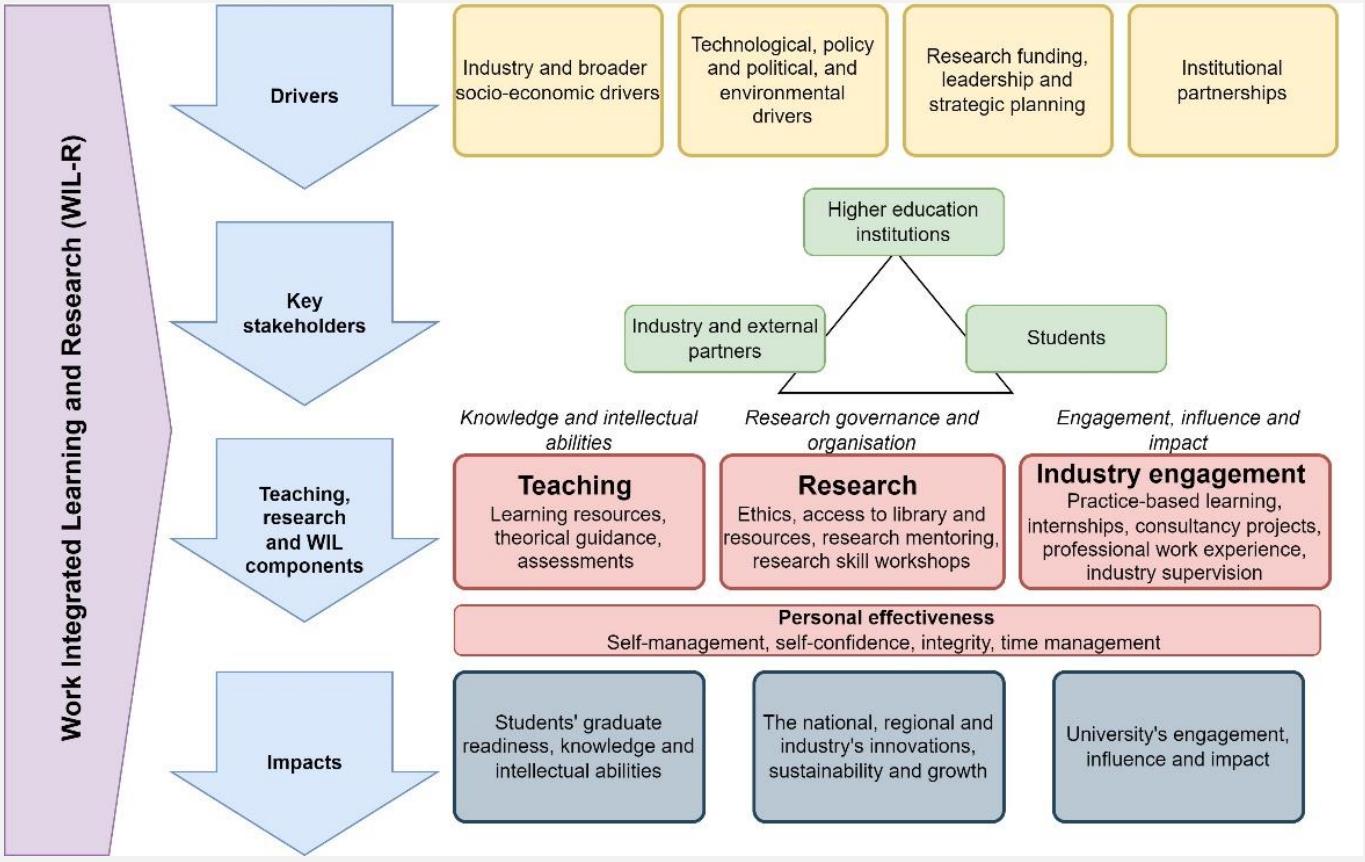

Figure 1: Work Integrated Learning-Research (WIL-R) framework.

Source: Authors' illustrations

- **Key stakeholders** – Adopted from Xia et al. (2015), the framework centrally positions the roles of education institutions (including academic staff, administrative support, and university management), industry and external partners, and students and the interactions between these stakeholders. "Within-stakeholder dynamics," such as those among students (if the WIL program involves group work) and between different parts of the university (for example, between academic staff, university management, and administrative support), should also be considered to ensure successful delivery of the WIL program.
- **Teaching, research, and WIL components** – The contribution of this new framework is clarifying the different components of teaching, research, and industry engagement involved in the WIL programs that include a research component. Adopting the RDF by Vitae (2011), the framework looks at the four domains that include knowledge, behaviors, and attributes of researchers, under which multiple sub-domains exist. In this research, we interpret those sub-domains as "research skills." Components under the **teaching** domain mainly focus on developing students' knowledge and intellectual abilities to do research. Research skills developed under the teaching program include the ability to collect and analyze data, discipline knowledge, critical thinking, and creativity. This is done through assessments and provision of learning resources. Meanwhile, the **research** domain is centered around introducing students to research governance and organization, which include research skills such as addressing ethics, professional conduct, and research project and risk management. In most undergraduate courses, these aspects are not always embedded in typical courses, hence the need to incorporate additional activities and resources such as research skill workshops. The last domain, **industry engagement**, facilitates authentic students' learning experiences by providing an opportunity for students to learn and work with the industry and demonstrate the applicability of their research to address real industry issues. Key research skills developed through industry engagement include working with others as well as communication and dissemination. Activities that fall under WIL programs that incorporate research activities vary greatly between institutions and programs. Xia et al. (2015), for instance, provide examples such as a research-oriented teaching methodology where students in the geographic information system (GIS) project management course apply the project management knowledge and skills they learn in class to solve real-life problems of an industry client, and a final year project where students work in a group on the spatial and temporal distribution of vehicle crashes for a transport agency, resulting in journal publications. Last, to succeed in the WIL programs that incorporate research components, students must also develop their **personal effectiveness,** including critical research skills such as self-confidence, upholding integrity, and time management.
- **Outcomes** – The RDF developed by Vitae (2011) is adopted to recognize the impacts of research as part of the WIL programs as well as partnerships built with the industry at the university, individual student, and broader levels such as the national, regional, and industry levels.

The framework presented in Figure 1 is important for demonstrating the different approaches to integrating research into WIL programs, as observed in the UQ, SAU, and IPB. These approaches will be detailed in Section 5.

5 A Multi-Institution Comparison of WIL Courses

This section is to showcase the experiences of UQ in Australia, SAU in Bangladesh, and IPB University in Indonesia. Specifically, four WIL courses that integrate a research component into the program are reviewed (Table 1), positioning them as fitting case studies for this study.

Table 1. Integration of Research into WIL Courses' Activities.

Course Name	AGRC3000 Food & Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
Type of research activities	A semester-long group project for real industry clients. In-person placement is not required. Projects include desktop research to review the literature, analysis of data and information, and providing practical recommendations to the client organization.	Empirical studies for one semester on real-world experiences (case studies) related to business and value chain management. A compulsory three-month internship with the clients. Methods include a literature review, observations, and primary and secondary data analysis.	A case study or assignment based on an industry field trip in the course, which includes desktop research to review the literature, analysis of the secondary data, and information gathered from the field trip and providing recommendations.	A case study or assignment based on an industry field trip in the course, which includes desktop research to review the literature, analysis of the secondary data, and information gathered from the field trip and providing recommendations.
Course learning objectives	• Critically analyze an agribusiness-related problem using an appropriate method • Work collaboratively with a client to develop a detailed plan to solve a specific agribusiness problem • Work collaboratively with the mentor to conduct research and analyze results • Document the results of research and analysis into a professional report • Articulate the results of research and analysis to different audiences and an agribusiness client	• Capable of effectively and efficiently demonstrating managerial functions within a tropical agribusiness system and enterprise • Capable of analyzing managerial problems within a tropical agribusiness system and enterprise • Capable of designing stages of problem-solving for managerial issues within tropical agribusiness systems and enterprises in the form of conceptual and operational frameworks • Capable of designing problem-solving alternatives or business models to address managerial problems within a tropical agribusiness system and enterprise • Capable of evaluating problem-solving alternatives or business models to address managerial problems within a tropical agribusiness system and enterprise	• Acquire knowledge of the fundamentals of agribusiness • Enrich knowledge of planning, organizing, targeting, and positioning an agribusiness • Implement knowledge about risk management of agribusiness in Bangladesh • Seek knowledge about the problems and prospects of Information and Communication Technology (ICT) in agribusiness • Detect major obstacles and opportunities in the Small- and Medium-sized Enterprise (SME) sector in Bangladesh	• Calculate the production costs and use the fixed/variable concepts in business decisions • Determine the different costs involved in agribusiness alternatives • Explain the financial management for agribusiness • Demonstrate the input sectors in Bangladesh • Determine the output and value-added sectors in Bangladesh's economy • Identify appropriate goal-setting activities that could be used for a farm business • Describe the Integrated Market Development (IMD) approach in the agribusiness sector • Show the role of niche marketing, product development, and product marketing in agribusiness • Identify how to obtain product, company, and industry knowledge and use it in a sales presentation

Table 1 Continued.

Course Name	AGRC3000 Food & Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
Examples of research topics addressed by recent students	• Sustainable packaging for agri-food products • Carbon-neutral agriculture • Identifying export opportunities • Developing strategies to achieve carbon-neutral agriculture • Marketing sustainable agriculture	• Internal and external analysis • Existing condition • Business model • Competitive advantages • Managerial issues identification (financial, human resources management, logistics) • Marketing strategy • Partnership • Consumer preferences for the company's product	• Existing supply chain and value chain of industry products • Marketing strategy • Business model	• Existing supply chain and value chain of industry products • Marketing strategy • Business model • Consumer preference for the company's product • Customer satisfaction with the company's product
Examples of analytical methods used in the research projects	• Financial analysis • Trend analysis • Marketing research • Supply chain analysis	• Business model development • Marketing analysis • Consumer preference analysis • Profitability analysis • Linear programming • Forecasting analysis • Partnership development strategy • Production efficiency analysis • Logistic regression for marketing channel choices • Business strategies formulation	• Trend analysis • Marketing research • Profitability analysis	• Trend analysis • Supply chain and value chain analysis • Marketing research • Profitability analysis • Consumer preferences analysis
Other learning activities or skills developed during the course	Workshops on research proposals, literature review, getting access to library resources, teamwork (including the group charter), analytical methods, and writing academic research	Literature review, workshops on writing proposals of program activities, business environment analysis, managerial problem identification, formulation of alternative strategies, consultation, activity documentation on logbook individually, writing reports, writing an academic paper, and conducting an exhibition of the program activities and the outcomes to wider audiences within the IPB community	Field trips, workshops and seminars, training on fundamental courses such as computer skill development run by the university computer club, short-term statistical courses, and academic writing	Field trips, workshops, seminars, consultations, training on analyzing data, and academic report writing

Source: Authors' compilation in consultation with academic staff involved in the course delivery

- **UQ's AGRC3000 Food and Fiber Case Studies III** – As a "capstone course," this course provides students with an opportunity to apply key conceptual frameworks, analytical tools, and knowledge of food and agribusiness that they have acquired throughout their agribusiness study into a realistic consultancy-type project.

- **IPB's AGB1423 Agribusiness Managerial Experience** – As a capstone course, this course is designed to provide empirical experience to students in applying conceptual and operational frameworks, analytical tools, skills, and knowledge of agribusiness sciences in planning, organizing, directing, and controlling tropical agribusiness enterprises.
- **SAU's AGBM125 Introduction to Agribusiness and AGBM475 Agribusiness Management**– AGBM125 is designed to provide fundamental knowledge on shifting procedures from the subsistence level of agriculture to commercialization, while AGBM475 is to provide knowledge on agribusiness performance, business management, market foundations and applications, agribusiness sectors, and product marketing.

The course descriptions presented earlier show that all four courses emphasize applying frameworks and fundamental knowledge to real industry agribusiness issues. This highlights the continued importance of discipline-specific knowledge in the WIL program despite its applied nature. The diversity of agricultural systems and educational programs is shown through each course's focus on agribusiness issues. UQ's AGRC3000 is formatted as a consultancy-type project to respond to industry demand directly. In this course, students are assigned into groups to complete a semester-long project. They work with a mentor, who is usually a PhD student in either agricultural science or agribusiness, to address issues presented by the client. In 2023, for instance, the course involved 17 client organizations ranging from a family farm business and a food processor, an industry association, to a multinational beef processing company. Consequently, topics and methods being used in students' projects vary greatly given the diverse nature of the clients and their issues. For example, one of the student groups explored an alternative interstate supplier base for a legume-based snack company in Queensland by researching both economic factors such as the cost of transport, competition with other buyers, and agroclimatic conditions. Another group researched market segmentation and factors affecting social media engagement before developing a new social media strategy for a pet food producer. While there is no requirement for students to have in-person placement activities, students meet the clients, either in person or via Zoom, regularly throughout the semester to ensure their progress and alignment with the client's expectations.

Meanwhile, given Indonesia's agricultural systems, IPB's AGB1423 is designed to provide real-life industry experience and highlights the importance of tropical agribusiness in its program. In this course, students must undertake a three-month placement at the client organization and are tasked to identify managerial problems that may exist at the organization before designing a project, which accounts for 50 percent of the total marks. The projects are focused on problem-solving using research methods such as forecasting analysis, linear programming, and consumer preference analysis depending on the client's issues.

SAU's AGBM125 and AGBM475 focus on industry case studies introduced to students during the field trip. While the field trip is a typical WIL activity, the research component is embedded in the case studies. In AGBM125, which serves as an introduction to agribusiness for SAU's first-year students in its Bachelor of Agricultural Economics program, students are tasked to collect data during the field trip to small- and medium-sized enterprises (SMEs). Then, they analyze the client's production costs, financial performance, and marketing before presenting recommendations on navigating SMEs' barriers to shifting commercial agribusiness. Meanwhile, AGBM475 delves further into agribusiness management while still using a case-study approach. Final year students in SAU's Bachelor of Agricultural Economics program research financial, marketing, and supply chain management applying more advanced techniques in supply chain, consumer, and financial analyses. The design of these courses follows the University Grant Commission of Bangladesh (UGC) approved curriculum, which was a "Higher Education Quality Enhancement Project" (HEQEP) funded by UGC (Government) special project for curriculum development in 2019 to enhance the quality of higher education aligned with developing industry and embrace opportunities (Sher-e-Bangla Agricultural University, Institutional Quality Assurance Cell 2019).

Referring to the WIL-R conceptual framework derived in Section 3, the next section looks into more detail into (i) teaching; (ii) research and WIL components; and (iii) challenges and opportunities. The comparison and associated tables (Tables A1 and A2 in the appendix on course description and challenges and opportunities) provide a detailed illustration of the various methodologies and practices used to embed research into WIL programs, showcasing the intricacy and variety of such integrations and their potential effects on student learning and outcomes.

5.1 Comparison of Teaching Aspects

Most WIL programs are offered to final-year students. Three courses, ARGC3000 at UQ, AGB1423 at IPB, and AGBM475 at SAU, are offered to the final-year students in Bachelor of Agribusiness at UQ and IPB, and Bachelor of Agricultural Economics at SAU, respectively. This offering to the final-year students is a typical format for a WIL consultancy-type program, given the purpose of the program to apply discipline-specific knowledge requiring them to complete core courses before being able to solve industry problems. However, this does not necessarily mean that WIL programs are only appropriate for final-year students. At SAU, AGBM125 is offered in the first year. UQ also has AGRC1012 Food and Fiber Case Studies I, and AGRC2000 Food and Fiber Case Studies II for first- and second-year students, providing them opportunities to engage with the industry through, for instance, developing a business canvas in AGRC1012 and case studies in AGRC2000. The difference between these courses and the final-year one is the flexibility and expectation for students to define research problems and select analytical tools to solve industry issues.

Teaching resources and facilities are provided to students undertaking WIL programs in different formats. These are critical given the core and intensive nature of the WIL courses. At UQ and IPB, for example, AGRC3000 and AGB1423 require about 20 hours of learning per week. At UQ, in addition to independent study, students must participate in lectures, workshops, client meetings, and group work. Regarding resources, technologies such as the Blackboard learning platform, and communication and interaction facilities, including Zoom, Slido, and Ed Discussion Board have been used by UQ, while IPB uses an e-learning platform (Centralized Learning and Aptitude Support System, or CLASS) and communication facilities like WhatsApp and Google Drive. The online platforms are particularly important for universities offering WIL programs to online students (or external students within the UQ context). UQ also uses a relatively new BuddyCheck peer assessment tool, given the group work assessments in this course, hence the importance of peer assessment to monitor and evaluate teamwork.

Furthermore, some courses have recommended textbooks, with UQ providing both science- and business-focus textbooks, indicating the diversity of topics students address in their industry projects. Meanwhile, SAU focuses more on agribusiness management. Using learning modules developed by academic staff is also common to tailor to specific students' needs and industry contexts. Support is provided not only by academic staff but also by the clients.

In terms of learning assessments, AGRC3000 at UQ and AGB1423 at IPB incorporate teamwork assessments. At the same time, SAU's two courses provide a more flexible arrangement for the academic staff to decide whether individual or group assessments are applied. Similarities are observed in terms of assessments, such as presentations. All the reviewed courses, except AGRC3000 at UQ, have exams and participation as assessment items. AGB1423 at IPB also mandates students to organize an exhibition to showcase their learning outcomes to the broader IPB community.

The three universities provide a wide range of support for students to conduct research as part of their WIL course learning activities. There is a consistent pattern across all the reviewed courses regarding the involvement of academic staff and the industry. Additionally, UQ students in AGRC3000 also receive support from mentors, typically PhD students within the School of Agriculture and Food Sustainability. There are approximately ten students per mentor. In this structure, mentors are vital in bridging communication between the course coordinator, students, and client organizations. This is in line with a previous study that highlights the roles of mentors in facilitating learning by providing

guidance, feedback, and support to students in their WIL experience (Wang, Gill, and Lee 2023). Moreover, the involvement of other university staff members, such as library staff, learning advisors, and academic coordinators, is also critical. Students' research that includes primary data collection may also involve the ethics committee.

5.2 Comparison of Research and WIL Aspects

Referring to Table 1, the types of WIL-R activities vary between courses. UQ's AGRC3000 does not require an in-person internship as part of the course, while IPB's AGB1423 sets a three-month internship compulsory. The two universities include client projects involving a literature review, data collection, and data analysis, while SAU's AGBM125 and AGBM475 ask students to do a case study based on field trips. Given the ethics requirement, data collection activities at UQ typically do not involve primary data collection.

Research involving human participants at UQ requires ethics review, as in other Australian universities. If the data collection activity is to be published as research formally, then an ethics review will be required. However, an ethics review would not normally be required if it is an educational or learning exercise for students in an assessment with no intention of formal publication. This highlights the importance of students and academic staff's understanding of ethical requirements in research.

Regarding research topics and analytical methods, the four courses share similarities in terms of their business focus and differences. Agribusiness management topics and tools, including financial, marketing, and supply chain analysis, are observed across all the reviewed courses. In Australia, however, there is a stronger push toward sustainable agriculture, reflected by the topics addressed, including carbon-neutral agriculture, marketing sustainable agriculture, and sustainable packaging. With more than 70 percent of Australian agricultural produce being exported, identifying export market opportunities is another topic many industry clients have requested for students in AGRC3000. While sustainable agriculture has also gained some traction in developing countries like Indonesia and Bangladesh, it is observed that consumer analysis, business development, and supply chain analysis seem to still dominate undergraduate WIL project topics at universities such as SAU and IPB.

UQ, SAU, and IPB also provide students with opportunities to develop personal and professional skills. Activities such as workshops cover two areas: research skills and personal and professional effectiveness, as shown in the WIL-R conceptual framework in Figure 1. The research skills workshops include literature reviews, library resource utilization, analytical methodologies (including statistical analysis), and writing skills. There is also a greater emphasis toward "soft skills" such as teamwork, project management (e.g., developing an effective task allocation), and interpersonal communication skills within the WIL programs.

5.3 Opportunities and Challenges

The WIL-R framework in Figure 1 indicates various outcomes that WIL and undergraduate research programs can achieve. There is a consistent message across the three universities that the WIL programs provide opportunities for students to improve their graduate and industry readiness. Drivers of this outcome vary, including alignment with the national program, such as Indonesia's *Kampus Merdeka*, a policy issued by the Indonesian Ministry of Education and Culture and support from alumni working in the industry. Outcomes from the WIL and undergraduate research programs are also identified at the university level, such as opportunities to leverage the partnership to greater academic and research excellence collaborations.

Several challenges are also identified. First, the intensive nature of the WIL course can pose significant challenges for students, as observed in UQ's and SAU's courses. For example, in AGRC3000, students must complete the client project in less than thirteen weeks while doing two other courses. This tight timeline means a limited period for them to collect primary data that requires an ethics clearance if

the project report is to be published. It also implies the importance of carefully determining the project scope while meeting clients' expectations.

Second, industry engagement can sometimes be challenging. First, there is a consistent observation across UQ, SAU, and IPB on alignment between academic requirements or curriculum and industry needs. For example, a literature review is critical in academic writing but is not seen as an important task among industry clients. Given data issues, the application of analytical techniques students learn in their university studies is not always straightforward. Students often have restrictions to access the company's internal data, limiting their understanding of the topics being posed by the clients. Second, in AGB1423 at IPB and in AGBM125 and AGBM475 at SAU, the primary challenge is establishing partnerships with and securing client support. In AGB1423, there is a high demand from students to do internships as part of this course, but as of this year's offering, only a quarter can be accommodated in this course. Other students can enroll in other capstone courses. Therefore, a growing need for additional corporate partnerships necessitates a strategic approach to identify and engage potential collaborators effectively. On the other hand, for AGRC3000 at UQ, while support from the industry is evident, given the tight timeline, ensuring successful course delivery requires intensive engagement between academic staff and the clients before the semester starts. In AGRC3000, the course coordinator works with the clients to create an introduction video where the client provides an overview of their organization and explains possible topics that students can work on. Tools like Zoom and Canva video editor help complete this task, though the task remains time-consuming and requires video editing skills that not all academic staff members have. These videos are then made accessible to students at the start of the semester so that they can nominate their preferred clients. This series of activities highlights the resource requirements of WIL course delivery that involve not only the teaching and research capabilities of the academic staff involved but also other sets of skills.

6 Conclusions and Recommendations

This study is one of the first to link undergraduate research and WIL programs in the post-pandemic era. A novel WIL-R conceptual framework is proposed in this study, explaining the various drivers, stakeholders, teaching, research and WIL components, and outcomes from the implementation of WIL and research programs. While this study focuses on agricultural programs, the framework can be applicable to other disciplines.

Guided by the framework, this study presents a comparison of undergraduate WIL programs in agribusiness at UQ, SAU, and IPB. The comparison highlights various program attributes and research activities, as well as opportunities and challenges in delivering undergraduate WIL programs. Despite their differences, these programs share the common objective of equipping students with the necessary skills to apply discipline-specific knowledge, theories, and frameworks they learn in the classroom to real-world industry contexts. They achieve this through specialized courses that align with national and agricultural industry contexts. For instance, UQ's AGRC3000 significantly emphasizes real industry issues such as agricultural sustainability and global market opportunities in line with Australia's agriculture sector's focus. Meanwhile, IPB's AGB1423 and SAU's AGBM125 and AGBM475 focus on agribusiness managerial abilities and management skills such as marketing, finance, and supply chain to support the countries' growing agribusiness industries.

Understanding the challenges facing WIL course delivery highlights two key points. First, finding "a middle ground" on the level of support, assessment types, topic selection, and project management approaches that can meet both the university's and industry's requirements and expectations remains a challenge. Consequently, as the second point, maintaining engagement with the industry requires strategic and continuous approaches and resource allocation. Such engagement should not only be initiated prior to the WIL program offered to the final-year students but also adopt a "scaffolding" approach introducing the industry involvement in WIL course delivery in students' early years before

their transition to a more independent consultancy-type project in the final year. At the institutional level, the setting up of an industry advisory group might also be beneficial to inform how the university should develop its curriculum and industry engagement strategies, including WIL programs. The significant roles of students in strengthening this university-industry partnership are also critical, hence the importance of embedding strategies to improve students' soft skills and broader professional development as part of the WIL courses.

With support from the industry, government, and university management and strong demand from students, WIL and undergraduate research programs are expected to gain growing importance. To this end, the framework and three universities' experiences presented in this study can inform academic staff, industry representativeness, and university management on practical strategies to enhance student experience and emphasize the continued importance of university-industry linkages. If optimized, such linkages can lead to greater outcomes, including research and education excellence and contribution to a competitive and sustainable agricultural industry supported by the next agricultural generation. While direct evidence of research-enhancing student outcomes might not be immediately apparent, the study is still in a conceptual phase. The authors acknowledge the need for more concrete evidence demonstrating the impact of research on student outcomes, indicating a direction for future investigation.

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Appendix: Course Descriptions, Opportunities and Challenges

Table A1: Course Description.

Course name	AGRC3000 Food and Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
School/ Department and University	School of Agriculture and Food Sustainability Faculty of Science • The University of Queensland	Department of Agribusiness Faculty of Economics and Management • IPB University	Department of Agribusiness and Marketing Faculty of Agribusiness Management • Sher-e-Bangla Agricultural University	
Students	Bachelor of Agribusiness third (final) year students	Bachelor of Agribusiness fourth (final) year students who have met the prerequisite course requirements and have completed a minimum total of 105 credit hours, typically, in their seventh semester	Bachelor of Agricultural Economics first-year students	Bachelor of Agricultural Economics fourth (final) year students
Course duration and semester	One semester (13 weeks); Semester 2 (July–November)	One semester (16 weeks); Semester 2 (July–December)	One semester (16 weeks); Semester 1 (January–June)	One semester (16 weeks); Semester 2 (July–December)
Enrolment mode	Internal (on-campus) and external (online) modes	Internal (on-campus)	Internal (on-campus)	Internal (on-campus)
Credits/ Units and Learning hours	4-unit course; 3 scheduled learning hours per week; up to 20 hours of learning per week, including independent study; 3-hour workshops in Weeks 1 to 5 on research skills	11-unit course; 495 learning hours in one semester, equivalent to 21 learning hours per week	Three scheduled learning hours per week (42 hours in one semester)	Three scheduled learning hours per week (42 hours in one semester)
Compulsory (core) or optional (elective)	Core course	Core course	Core course	Core course
Technology use	Learning and communication platforms: Blackboard, BuddyCheck peer assessment, Ed Discussion board, Slido for class interactions, and Zoom	Blended learning: Face-to-face and online platforms including e-learning (Centralized Learning and Aptitude Support System: CLASS), Zoom, WhatsApp, and Google Drive	Face-to-face	Face-to-face

Table A1 Continued.

Course Name	AGRC3000 Food and Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
Resources (e.g., textbooks)	• Module including research skills (e.g., literature review, analytical methods, etc.) • Zikmund, William, et al. 2019. *Business Research Methods*. Cengage. • Sahu, P.K. 2013. *Research Methodology: A Guide for Researchers in Agricultural Science, Social Science, and Other Related Fields* (Vol. 432). New Delhi: Springer.	• Module • Literature related to agricultural business management • Industry-related data where the business operates • Relevant previous course material	• Broadway, A.C., and A.A. Broadway. 2002. *A Textbook of Agribusiness Management*, 1st ed. New Delhi, India: Kalyani Pub. • Ricketts, C., and O. Rawlins. 2001. *Introduction to Agribusiness,* 1st ed. Delmar Pub. • Recent industry reports and agribusiness literature	• Barnard, F., J. Akridge, F. Dooley, and J. Foltz. 2000. *Agribusiness Management*, 4th ed. Waveland Publisher. • Beierlein, J.G. 2008. *Principles of Agribusiness Management*, 4th ed. Waveland Publisher. • Nutz, N., and M.A. Sievers 2010. *Rough Guide to Value Chain Development, How to create Employment and Improve Working Conditions in Targeted Sectors,* 1st ed. ILO Publication. • Recent industry reports and agribusiness literature
Assessment	• Group project proposal (20%) • Final group presentation (20%) • Group final report (30%) • Peer evaluation, reflection, and evidence of individual contribution (30%)	• Participatory activities (25%) • Project results (50%) • Orientation class exam (10%) • Expo and oral presentation (15%)	• Quiz/assignment (10%) • Class test/assignment/ oral presentation (30%) • Class participation/ attendance (10%) • Final exam (50%)	• Quiz/assignment (10%) • Class test/assignment/ oral presentation (30%) • Class participation/ attendance (10%) • Final exam (50%)
Academic support and supervision	• Course coordinator, mentors (PhD students; approximately ten students per mentor), and supervisor at the client organization	• Course coordinator, teaching team (lecturers), and supervisor from the company	• Course coordinator, teaching team (lecturers), and guest lecturers from industry	• Course coordinator, teaching team (lecturers), and guest lecturers from industry

Source: Authors' compilation in consultation with academic staff involved in the course delivery

Table A2. Opportunities and Challenges

Course Name	AGRC3000 Food and Fiber Case Studies III	AGB1423 Agribusiness Managerial Experience	AGBM125 Introduction to Agribusiness	AGBM475 Agribusiness Management
Opportunity	• The use of learning technology to support WIL programs • Strong support from the industry and students' high interest in linking with the industry, hence the positive outlook of the course • Leveraging alumni networks working in the agribusiness industry • Opportunities to extend for teaching purposes and industry engagement to research partnership	• Alignment with the Indonesian national government curriculum so-called *Kampus Merdeka* (independent campus) and budget • Existing companies' internship programs that the course can connect to • The presence of alumni working in the companies to support students • Students may continue researching the clients for their bachelor's thesis, thus speeding up the research process • To align the curriculum with industry needs • A means to apply the Three Pillars of Indonesian higher education (education, research, and community services) by collaborating with the industry	• The use of technologies to support effective learning • Field trips and assignments to experience real problem-solving • Opportunity to work in the industry after graduation • Group work to develop team skills	• The use of technologies to support effective learning • Field trips and assignments to experience real problem-solving • Opportunity to work in the industry after graduation • Group work to develop team skills • Alumni support in different organizations
Challenges	• Pre-semester intensive engagement with the clients • Short project duration (13 weeks), therefore intensive load • Students typically need to do two other courses during the semester, hence challenging time management • Group dynamics • Ensuring effective and efficient communication between the teaching staff, students, and the clients • Determining the project scope • Balancing between meeting clients' expectations and embedding academic research into industry projects • Ethical requirements to collect primary data	• Initiating partnerships with the right client • Aligning the perception between higher education curriculum and the needs of the business world • High student demand but limited capacity, hence a very competitive selection process. The need for more partnerships with companies in the future	• Securing more support from the industry • High coursework in each semester makes it challenging for students to do effective learning • Aligning between the course curriculum and the needs of the business world	• Securing more support from the industry • High coursework in each semester makes it challenging for students to do effective learning • Aligning between the course curriculum and the needs of the business world • Translating the case study or assignment experience into research skills • Resources to organize workshops or invite guest lectures

Source: Authors' compilation in consultation with academic staff involved in the course delivery

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Teaching and Educational Method

From Zero to Thesis in Two Years: A Curriculum Plan for Engaging Undergraduates in Honors Research

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JEL Codes: A11, A22
Keywords: Honors program, mentoring, project management, thesis, undergraduate research

Abstract
An undergraduate honors program in agricultural economics confers a multitude of advantages, fosters an enriching academic experience, and propels students toward professional excellence within the agricultural sector. A major difficulty that many programs must manage is how to get more students interested and engaged in these programs, particularly as new pathways to our programs are developed. There is a lack of standardization concerning honors content and processes, particularly for transfer students. In programs that are commonly considered "found" majors, students may have the potential for honors research, yet are not sure how to engage in the short two years in the major. This article details existing honor program structures and offers a pathway toward a rigorous and comprehensive curriculum tailored to students who have two years to complete their program. The first year focuses on building a strong foundation in their field. In the second year, students embark on a specialized research project under the guidance of experienced faculty mentors. At the program's conclusion, participants will have engaged with the complexities of agricultural economics and honed their critical thinking, research, and communication skills.

1 Introduction

One common way to engage students in research is to enroll strong students in honors colleges and undergraduate research experiences, and mentor them through the writing of an honors thesis. As the number of undergraduates coming from farming backgrounds declines and high school dual enrollment increases, many programs are left with a smaller body of students from which to draw academically strong and ambitious students as first-time in college (FTIC) freshmen. For example, in the authors' department, only 13.3 percent of FTIC students graduating from 2018 to 2023 in agricultural economics started in agricultural economics, 57 percent transferred in from community and state colleges, and the average credits for those transfer students was 55 credits (just shy of an associate's degree, on average). Even once a talented candidate or even a few candidates enroll, it may be difficult to provide a quality program for these students that fully prepares them to engage in research as undergraduate students. Given the breadth of career pathways available to students in agricultural economics and agribusiness, programs may struggle with providing an honors program that enriches the experience for the students while still allowing for a non-FTIC student to graduate on time and with honors. This article offers insights into how to incorporate research into existing curricula and bolster the individual research process required to equip students with an understanding of the intricate interplay between economics and agriculture within two academic years. We argue that it is not only possible but also rewarding to offer a chance for undergraduate-driven research to non-FTIC or within-institution transfer students to better fill the pipeline of agricultural economists well into the future.

Academic administrators and professors have long made efforts to provide differentiated instruction and curriculums to excelling undergraduates. Undergraduate honors education somewhat resembles organized attempts at K–12 gifted education in the United States, which began in the late

1800s (Rinn and Plucker 2019). Kutzke et al. (2020) surveyed honors and non-honors students, and they found that interest in honors may increase if connections between honors and their majors/colleges were more apparent. A primary benefit of an honors program in agricultural economics is the provision of a highly challenging and intellectually stimulating environment for students who may not fully know what agricultural economists do. This is increasingly important as we grapple with preparing our students for graduate programs in agricultural economics when our undergraduate programs may not fully encapsulate the mathematical and econometric skill set required for success in a graduate program even within the same institution.

As early as 1988, Lester Manderscheid sounded the alarm with an article in the *American Journal of Agricultural Economics* on "Undergraduate Educational Opportunities in the Face of Declining Enrollments." At that time, agricultural enrollments had dropped 35 percent in only one decade at our land-grant institutions (Manderscheid 1988). Even more concerning is the impending "enrollment cliff," which some attribute exclusively to the drop in the fertility rate brought on by the 2008 to 2011 recession (Copley and Douthett 2020). Just this year, the AAEA Presidential address focused on the demographic cliff, pointing to concerns such as rising college costs, outside opportunities, and social shifts in the perceived value of higher education (Nayga, Liu, and Kassas 2024). Like the concern raised by Manderscheid in 1988 and echoed by Nayga in 2024, many of us are left wondering what we can do with the finite pool of students in the brief time we have them to ensure the field of agricultural economics will endure into the future.

To have future agricultural economists, we must expose students as early as possible to our field and the possibilities therein, even as we shift our recruitment efforts to community colleges and degree pathway programs (Nayga et al. 2024). Honors research provides an opportunity to (1) expose students to the types of research done in our field, (2) create a pipeline of students who participate in our annual meetings, and (3) draw better students to our field in the hopes of attracting a better student body overall. Honors students are generally expected to engage in advanced coursework that delves into the intricate economic principles governing the agricultural domain. This enhances their theoretical knowledge and hones their ability to apply economic models to real-world agricultural scenarios. Commonly, programs are focused on a four-year approach that is typical of an honors college; however, this is potentially missing a large number of these transfer students.

The authors of this paper have embarked on this effort over the last few years when it came to our attention that only around 1 percent of our undergraduate students had completed a thesis in a five-year period (2018–2023). Through targeting junior students and following the program, we define in this paper, we have increased our honors students to 10 percent of our student body and are engaging over 50 percent of students who were eligible to complete an honors thesis in this Spring 2024 graduation term. The remainder of this paper will summarize existing institutional frameworks for honors research, defining key features of various program types. Next, we propose a framework for engaging students in under a two-year timeline, including concrete examples of curriculum and institutional adjustments that can be a model for engagement at other "found" major[1] programs. Finally, we provide an assessment of our program and define characteristics of students likely to be successful in this program.

2 A Review of Honors Programs

Honors programs are valuable because they emphasize research and independent analysis, promoting a culture of curiosity and scholarly exploration. However, there are several structures to honors programs that are worth discussing to provide a common language for the experience. Research experiences for undergraduates (REU) include any educational activity where undergraduate students actively engage

[1] While all programs probably have their own flavor of within university transfer students, many of our "found" majors come from engineering (30 percent) and business (20 percent).

with the research process concerning problems in their discipline (Zimbardi and Myatt 2014). While a student need not be involved in an honors program to engage with REU, an honors thesis within an REU is a common theme among many programs. In honors research, students are typically guided by qualified faculty members from their institution, allowing for impactful mentorship and collaboration on original research projects. This exposure develops research expertise and nurtures critical thinking and communication skills. These skills are vital for disseminating findings effectively to diverse audiences.

2.1 An Overview of Honors Study Frameworks

Some programs require a thesis to graduate "with honors" while others are strictly based on a grade point average (GPA) requirement. Some universities have students enroll in an "honors college" and require specific coursework in addition to a thesis. Other programs may not specify courses but rather require a certain number of credit hours to be honors sections of already offered courses. Graduating with honors from an American university solely based on GPA involves maintaining a certain GPA throughout your undergraduate years. This recognition is often categorized into tiers, such as cum laude, magna cum laude, and summa cum laude, each representing varying levels of distinction based on GPA. Universities set GPA thresholds for each honors level, such as a GPA between 3.5 and 3.7 for cum laude, between 3.7 and 3.9 for magna cum laude, and above 3.9 for summa cum laude.[2] Meeting the GPA threshold places a student into consideration for these honors. Sometimes to achieve these designations, they must fulfill other academic requirements of their chosen major and any additional criteria specified by the university or college. These requirements usually relate to a minimum number of credit hours in specific subjects. Upon graduation, if all the established criteria are met, they are granted the appropriate honors designation, often indicated on their diploma and official transcripts.

On the other hand, an honors certificate often involves completing an honors thesis—a research project displaying a student's expertise in their field. The process often includes signing up for the certificate program, selecting a focused topic, creating a proposal detailing objectives and methods, conducting a thorough literature review, collecting and analyzing data, and drawing conclusions. In this model, students often enroll in research credit in their final semester as they prepare their thesis for final submission to the college, university, and/or a student research journal. Typically, a student works closely with a faculty advisor and is expected to contribute innovative ideas to their chosen field. This is a rigorous academic endeavor that highlights the student's commitment to academic excellence and is often celebrated with a public presentation or defense. Unfortunately, while some high-achieving students actively look for research opportunities and plan to graduate with honors, other high-achieving students do not have the knowledge or mentoring needed to seek out research experience, thus losing out on this important skill set and the opportunity to achieve honors status (Martins and Goss 2023).

Finally, a university honors college is an exclusive academic program that appeals to particularly motivated and high-achieving students. It typically offers an enriched learning environment within the larger university setting. Students admitted to the honors college, often as freshmen, are presented with a specialized curriculum emphasizing critical thinking, interdisciplinary exploration, and heightened engagement with their chosen fields of study. Classes are typically smaller in honors colleges, fostering closer interactions between students and faculty. This facilitates a more personalized education experience with greater opportunities for discussions and collaborative learning. Faculty who teach honors courses are more likely to encourage engagement in the areas of student–faculty interaction, learning strategies, and collaborative learning (Miller, Silberstein, and Bracka Lorenz 2021). An additional advantage of the honors college approach is the sense of community it promotes. Honors

[2] This GPA designation also differs by institution; some institutions for example require a 4.0 for the summa cum laude designation and have the breaking point between cum laude and magna cum laude at 3.75. For further examples, see the University of Florida's College of Agricultural and Life Sciences honors requirements, https://cals.ufl.edu/getinvolved/honors/honors-requirements/.

students often reside together in dedicated housing, creating an environment where education extends beyond the classroom. This encourages a collaborative exchange of ideas and the potential for lifelong friendships among peers who share a passion for learning. These strategies are often priorities for those who work in honors colleges or with honors students (Miller et al. 2021).

2.2 Drawbacks of Current Honors Frameworks

While honors programs can provide a valuable experience to undergraduates, there is a lack of consistency in these programs, and many of the existing frameworks are not accessible to the current student composition of many programs. One of the most substantial disadvantages is the variation in program quality. This can lead to difficulties meeting graduate program admissions criteria within our same field and a lack of the quantitative skills emphasized heavily in our graduate programs. This can be addressed by providing more rigorous research experiences to a select group of students who are targeted by their junior year as capable of rigorous research as proposed in section 4 of this paper.

A key concern of the lack of a standardized framework is that it can intensify educational inequities. Students enrolled in institutions with robust and well-regarded honors programs may benefit from more opportunities and resources, while those in institutions with weaker programs may lose opportunities for valuable academic experiences. This inconsistency further expands the gap between privileged and disadvantaged students.

Finally, graduating with honors and being part of an honors college learning community are often not accessible to transfer students, particularly when the GPA requirements are tied only to the university GPA (no community college hours factor as part of the calculation), and the honors courses are all offered at the freshman or sophomore level replacing general education classes that transfers have likely already achieved credit for and would be penalized from duplication.[3] Figure 1 illustrates for the authors' institution, the average credit hours brought in by each honors designation. Please note that at the University of Florida, students cannot earn "High Honors" or "Highest Honors" without writing a thesis. This means that engaging transfer students in honors credits is challenging and must be well-

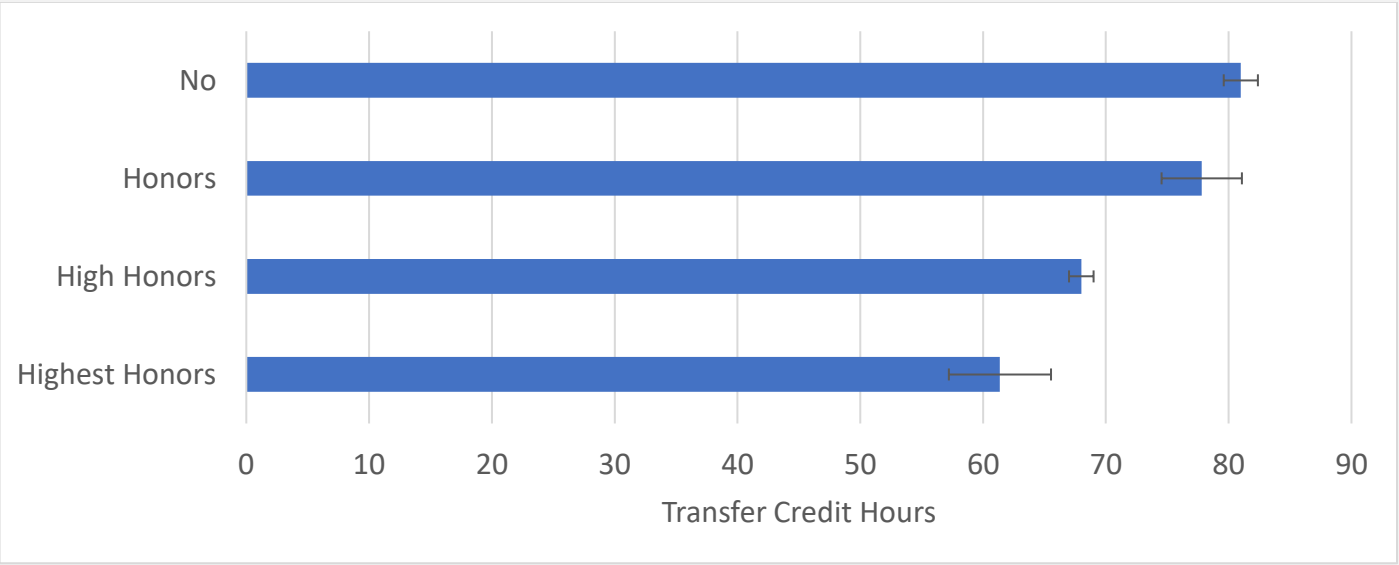

Figure 1: Example Average Credits of Agricultural Economics Graduates Upon Entering Studies at an R1 Four-Year University from 2018 to 2023 (N = 465)

[3] Some universities charge double tuition for "excess credit hours," which means all credits above a threshold (usually 130–150 credits). This means that transfer students are penalized if they want to try to take lower-level honors classes as these classes would not count toward their degree.

thought-out as the existing systems do not account for the challenges of being a community college transfer student, no matter how stellar the student.

A standardized approach could have clear program objectives that align with academic standards; more uniform requirements for admission, progression, and completion (such as GPA thresholds, course prerequisites, and credit hour requirements); and a more structured curriculum that covers essential topics in agricultural economics. This has the potential to improve learning outcomes by ensuring that students have competencies relevant to agricultural economics careers. Standardization also facilitates faculty collaboration and coordination in delivering the program, enabling faculty members to focus on providing effective teaching, mentoring, and support services to students. Perhaps the greatest benefit though is the increased opportunity for equitable access. Standardized admission criteria and transparent procedures promote equitable access to the honors program, ensuring that all eligible students, regardless of background or institution, have equal opportunities to participate and benefit from the program.

3 Standard Framework: Two-Year Program

To account for inconsistent curriculum and educational inequities, and to fill the pipeline of agricultural economists, we propose a framework to engage students in an honors research program beginning in their junior year. Figure 1 outlines a timeline for students who come to our programs as juniors (i.e., in their fifth semester of an eight-semester degree). If presented with a timeline like in Figure 2 early, students might find the prospect of doing a research project less intimidating and doable, even within two years.

Given the timeline in Figure 2, junior-level professors should start to engage students' interests in research and begin discussing possible research opportunities with students (see the timeline for the

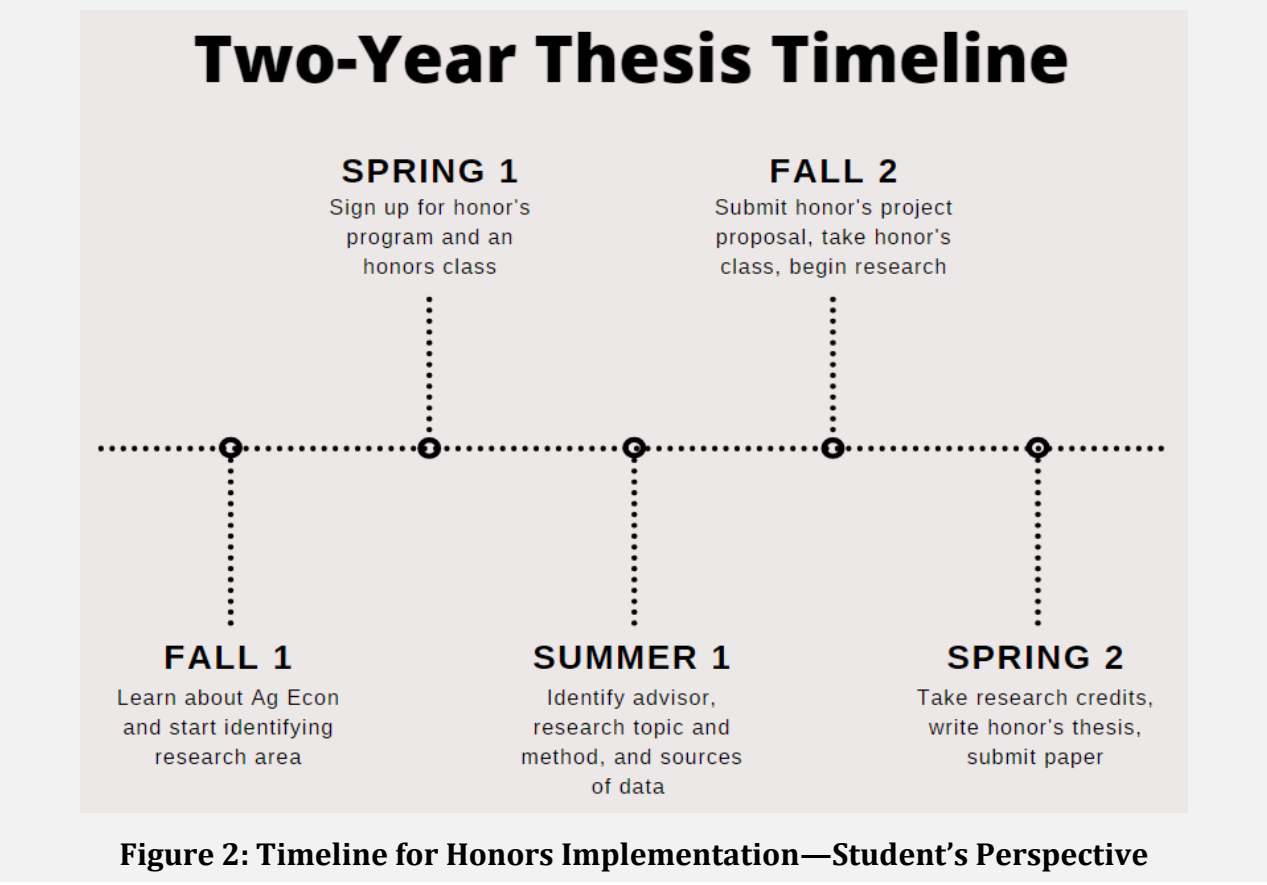

Figure 2: Timeline for Honors Implementation—Student's Perspective

professor in Figure 3). At many institutions, students must establish a university GPA before they can enroll in an honors program so getting them interested in the first semester ensures that they can enroll by their second semester (see the second node in Figure 3). At that point, it becomes imperative that the student begin to take honors classes or honors sections of classes to start meeting the honors credit requirements (typically between 9 and 15 hours). This is most easily facilitated by an agricultural economics program having honors sections of some of their junior-level classes (see next section for greater details).

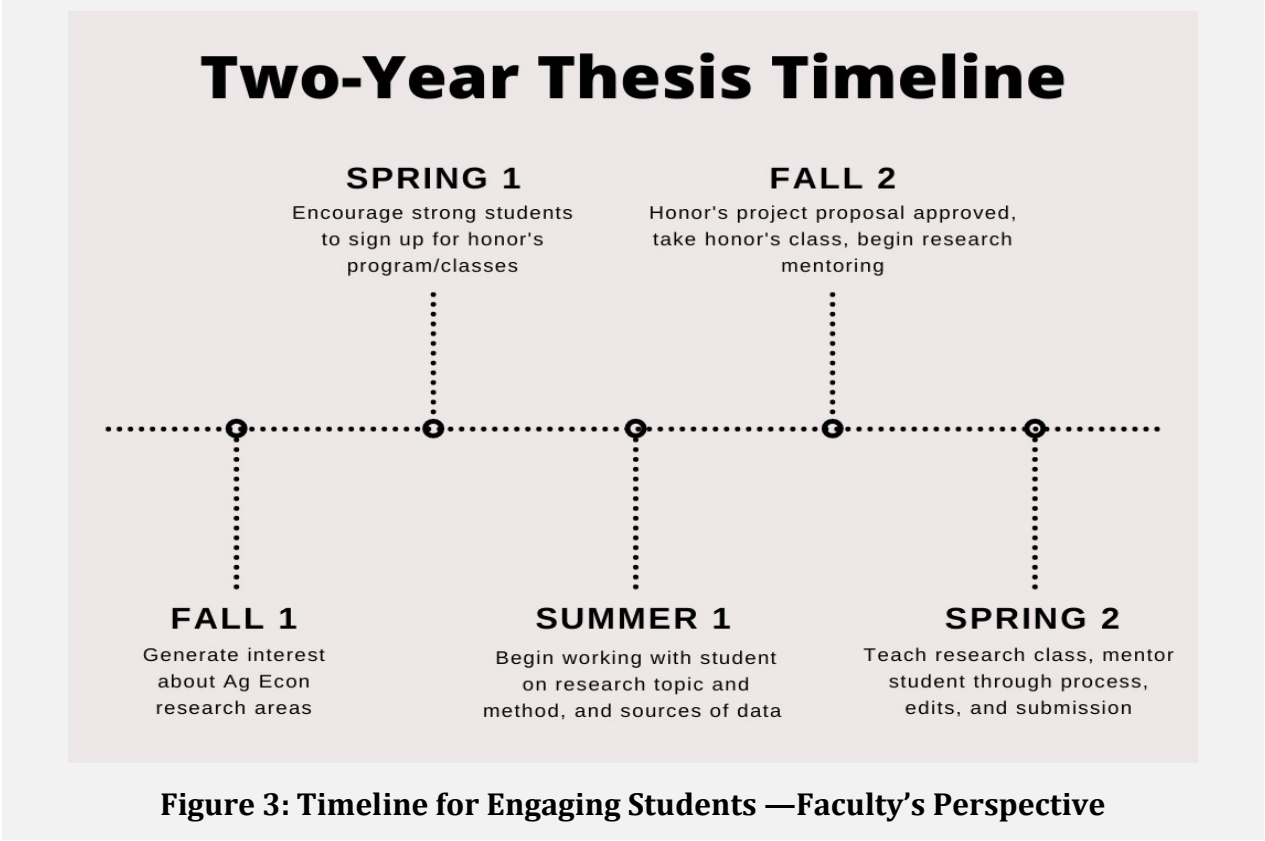

Figure 3: Timeline for Engaging Students —Faculty's Perspective

Once a student has committed to an honors certificate program, identifying a potential research area and the most appropriate mentor must happen quickly (ideally by the end of the junior year, as shown in Figure 2). While it is often the case that students will choose mentors who are their current professors, it is helpful if the undergraduate coordinator or honors coordinator[4] encourages students to seek mentors whom they may not have in class but who study the topic area of interest of the student. It may also be helpful for the research coordinator in each department to have an ongoing list of all faculty, their current projects or research interests, and their willingness to take on students. Many faculty engaged in large research projects that could benefit from undergraduate research assistance may not teach undergraduate students in their first or second semester after transferring. This limited exposure to students may make it challenging to pair the student with an appropriate mentor given their limited exposure to the field and viable research questions.

Once a topic area and mentor are chosen, it is critical that the student work on gathering background information and work with the mentor to identify sources of data. Often, it is the expectation that the student is not the one primarily responsible for data collection due to (1) a short

[4] Although not all programs will have an honors coordinator currently, we recommend in this standardized approach to create this service role because it helps tremendously to engage students in honors research and provides a consistent message about requirements.

timeline, (2) a lack of knowledge of research ethics and the Institutional Review Board process, and (3) inadequate technical skills in data cleaning and manipulation. If a student is going to participate in data collection, summer is the best time to do this while the course load is lowest for the student, and more one-on-one time can be spent with the mentor. The honors proposal is often due at least one semester before the graduating semester of the student (node 4 in Figure 2). This proposal is usually a short (1–2 page) abstract identifying the topic, contribution to literature, research questions, methodology, and data sources. In addition, if the student has not done so already, they should be taking classes for honors credit. It is highly recommended that the student be enrolled in coursework relevant to their thesis topic. It is also helpful for the student and mentor to begin meeting at least two times per month to ensure that the literature review and exploratory data analysis are progressing; if appropriate, this is when the student should apply for research conference presentation funding or other opportunities to highlight their research project. The next two sections outline course adaptations and structures that are supportive of this research process. These timelines culminate in a written work, at a minimum, and perhaps a publication, presentation (defense), or symposium participation requirement. Each institution keeps a repository of these theses, which can serve as examples to future students engaging in honors research.

4 Engagement in Class-Based Research

Understanding an honors thesis as a project is vital for the honors program and involves recognizing its project components, stages, and process in nature. We suggest three stages for engaging honors students toward the final honors thesis in our proposed two-year honors program. The three stages include a project management foundation, a class-based project (or an extension-based project) in an honors class, and an honors research class. Honors students can apply their developed project management and research skills to the final honors thesis and then complete the honors program.

4.1 Project Management Foundation

Requiring honors students to develop project management knowledge and skills before undertaking the honors project and thesis has proved effective (Reutter et al. 2010). As shown in the timeline (Figure 1), we suggest enrollment in an honors course in the second semester of the program, and ideally, this course should provide insights into research project management as it may be the first course a student takes that even discusses the idea of primary research. We propose integrating project management basics in a seminar/workshop-type or standalone course. For agricultural economics departments already offering research seminar courses, project management principles, tools, and techniques can be easily integrated into the seminar topics. If there are no such classes, perhaps in a principles of agricultural economics class, the professor can offer “application Fridays” where they showcase the applied work of their colleagues to draw attention to research and research methods that are commonplace in the department. The key here is to pique the interest of students in our field and the research that we do in the hopes that they will consider engaging in research in some way.

Alternatively, developing a standalone one-credit project management foundation course (PMC) can be considered. It is important to note that this PMC should be open to all students, not only potential honors, or strong students. The PMC aims to equip students with essential project management skills that enhance their ability to excel in class-based projects and research endeavors. This course covers the entire project lifecycle, from initiation to closure, and emphasizes practical skills necessary for successful project execution. The course makes students recognize the intricate nature of the project and research and the need for a systematic approach. This course merges the worlds of academia and project management, providing students with tools that streamline their projects and the research process. By integrating project management basics into honors programs, honors students will be well-prepared to approach their class-based projects and research with a structured and efficient mindset, leading to

higher quality outcomes and an enriched academic experience. Also, it is important to note that project management knowledge and skills are crucial when engaging honors students in class-based projects and research.

4.2 Class-Based Research Projects

Most honors students are required to take honors classes. These classes are sometimes offered at the college or university level; however, there is often an opportunity for programs to provide honors sections of regularly offered courses where students in these sections are asked to complete a class-based project or other additional course deliverable. This helps overcome the issues of duplicated general education classes that transfer students would have with taking "traditional" honors classes. For some institutions, class-based research projects are called "individually designed projects" (University of California, Davis 2023). The class-based project aims to evoke students' research interests and engage students in honors research and thesis development without a requirement that an entire thesis is produced in one semester and should be considered as a stepping stone toward the bigger project.

It is recommended that honors students conduct the class-based project with the support and supervision of course instructors in a structured way. The faculty and students should work to develop a project that fits within the scope of the class and provides challenging opportunities for the student while being achievable in one semester as a supplement to typical course activities. The project should be designed to be flexible, manageable, and consistent (Reutter et al. 2010). For example, the student may participate in a data analysis project in a junior-level statistics class[5] (Box 1), or the student may participate in a commodity price analysis project in an agricultural price analysis class (Box 2). In these two examples, the assignments are additional to what the class is already doing and to meet the requirements of the honors college they must constitute a 20 percent difference from the regular section of the course. The completed project should have at least one course deliverable, such as a project report, a presentation, a poster for conference presentations, and a learning reflection. Supplements 1 and 2 lay out the differences between the honors section and the regular section of these two courses.

It is important to highlight the significance of carefully managing the workload associated with class-based research projects in non-honors courses. While it is commonly perceived that integrating honor students and class-based projects into an existing course might impose a substantial burden on faculty, it is essential to acknowledge that some additional workload may arise in the context of accommodating a class-based project. Nevertheless, various strategies can be employed to effectively manage and distribute this workload.

The first strategy we consider is to use existing class projects. The honors component can be an extension or enhancement of the regular existing class project. Since the foundation is already laid during the standard coursework, the additional workload should be manageable. For instance, in the above-mentioned commodity price analysis project, incorporating a trading simulation for honors students adds complexity and depth to their learning experience. Moreover, involving PhD students and Teaching Assistants (TAs) in class-based research can allow the faculty to focus more on the honors components. TAs can play a crucial role in providing additional support to students, assisting with logistics, and managing the day-to-day aspects of the project. PhD students gain valuable experience in mentoring and teaching, contributing to their professional development.

There are additional benefits, either for teaching an honors course or adapting an existing course to accommodate honor students with a class-based project, for faculty and graduate students. First, faculty can transform their existing non-honors course into a potential honors course. It contributes to the institution's overall academic excellence. Also, the faculty taking on the challenge of adapting a

[5] This class ideally covers both descriptive and inferential analysis but stops short of being an "econometrics" course. The project in this case would more closely resemble "exploratory data analysis" and be a good starting point for a topic of interest.

Box 1: Data Analysis Assignment

This honors project will require students to collect their secondary data set from online data portals or a research faculty and analyze an economic phenomenon of interest. The analysis should tell a story about food, agriculture, and/or natural resources. It will involve using statistical tools learned throughout the semester, including descriptive and inferential statistics and their full interpretation. There will be three components of this assignment: (1) a 1-page proposal identifying the data source(s) and study objectives, (2) your Excel workbook with all original data and tables and figures provided in tabs, and (3) a professional report of your data analysis.

Learning Objectives:

1. Collect and organize data of interest to the student.
2. Analyze data using descriptive and inferential statistics.
3. Interpret descriptive and inferential statistics.
4. Create and explore research questions about a collected data set.
5. Display complex information in a visually appealing and creative way.
6. Present an application of data analysis in a coherent and informative format.

Box 2: Commodity Price Analysis Assignment

The Agricultural Price Analysis (APA) for honors students extends a regular APA project. It includes more sophisticated analyses regarding commodity price change and prediction, and several mocked trading simulations.
The APA project includes a commodity review, mocked trading, trading analyses, price prediction article review, commodity selecting, three months of price tracking and analysis, and fundamental analysis. The final deliverables include a trading report, an article review, a final price analysis report, and a poster.
Learning Objectives:

1. Develop analytical and project management skills in terms of agricultural commodities in the futures markets.
2. Explain the factors that influence the fluctuation of agricultural commodity prices.
3. Apply the economic knowledge and skills learned in class through analytic and experiential learning activities.
4. Analyze the commodity price changes using various analytical techniques.
5. Display the ability to do independent research on a specific commodity.

course for honors students can gain additional teaching, advising, and instructional accomplishments. This can lead to professional growth and recognition within the academic community. Faculty members who successfully adapt their courses for honors students and mentor honors students may include the honors work in the tenure/permanent status and/or promotion packets (Tenure and Promotion packets) packet and receive institutional recognition.

Concerns exist regarding administrators' ability to motivate faculty to create honors adaptations. Proposed systemic approaches include utilizing an honors and/or research coordinator for student

inquiries, streamlining the matching process, and fostering effective communication as mentioned previously. The coordinator can help match interested faculty with honors students, streamlining the process and ensuring effective communication. This helps identify willing and able faculty members, creating a network of support for honors initiatives. Administrators should consider implementing incentives, such as recognition, awards, or even additional professional development opportunities, for faculty who take on honors course adaptations and/or the role of a coordinator. In summary, emphasizing the benefits for faculty, coupled with a systemic approach involving a coordinator and incentives, can contribute to overcoming resistance and encouraging more faculty to adapt their courses for honors students.

4.3 Honors Research Thesis Class

If a student is required to write a thesis for their honors program, they are typically required to enroll in research hours[6] during their final semester. The supervisor for this course will ideally be the faculty mentor for the thesis (identified in the student's junior year), but it may also be a course facilitated by a central instructor with input from faculty mentors. The faculty mentor or course facilitator should engage students in a constant cycle of submission, review, and revisions so that each week in the semester marches the project forward (see Figure 4). If following a sixteen-week semester, this class should move the student through the process of finalizing their thesis. Box 3 outlines a sixteen-week timeline for writing the thesis in one semester under the assumption that students have some foundation through the preparation of their proposal and engagement in either project management or course-based research. Supplement 3 provides a syllabus template for this course addressing issues related to satisfactory/unsatisfactory grading and course expectations.

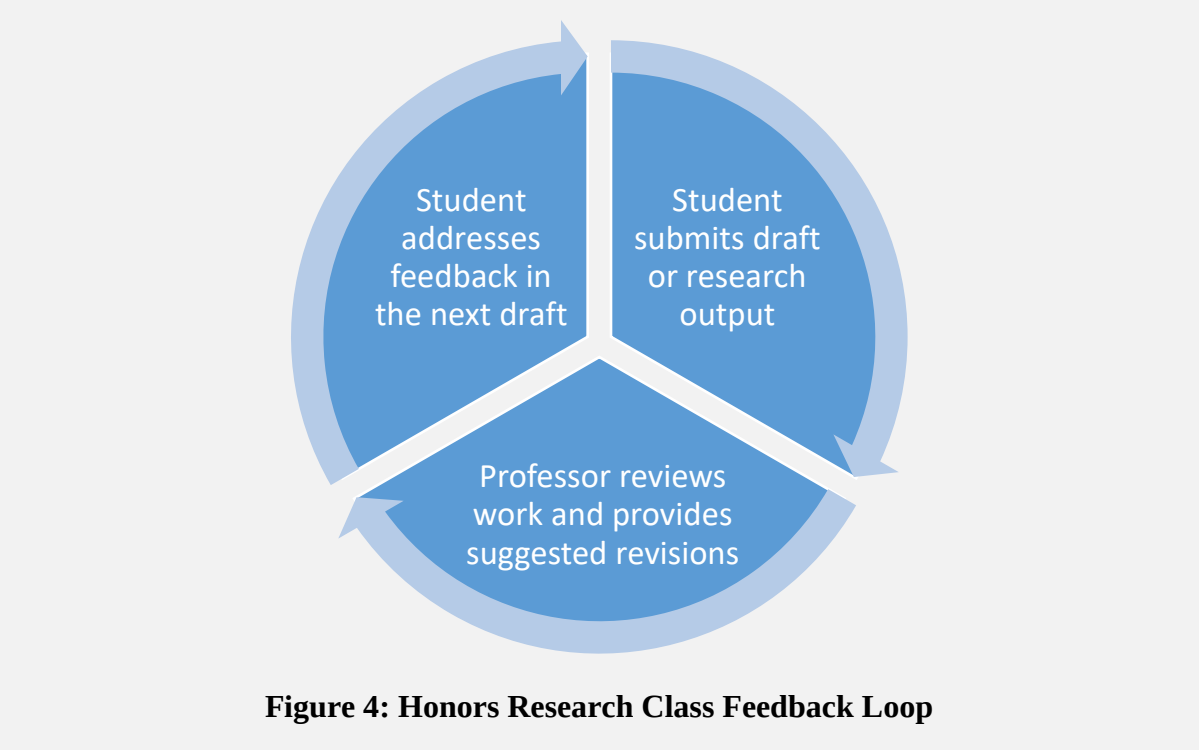

Figure 4: Honors Research Class Feedback Loop

[6] It is common for students to be enrolled in three credits, but it is also possible that a student enrolls in fewer hours if (a) they already have their required honors credits with other courses and do not want to pay the course fees, or (b) if a student is in danger of running into excess credit hours or some other administrative issue that makes taking three credit hours impossible but they still need the class even though there are zero credits associated with it.

Given that students who enroll in the research class have project management experience through their PMC, course-based research, and proposal submission, the timeline provided in Box 3 should be doable. Nevertheless, there are always challenges that are not anticipated throughout the course of the semester. For example, there may be too few responses from a survey to draw any meaningful conclusions, a student may not have adequate data analysis skills and may need a great deal of support, or a student may become despondent when they realize that they are soon to graduate, and they hate research. While each of these issues can delay research for those of us who are full-time researchers, for students, they can mean the difference between graduating with honors and not graduating with honors. It is recommended that faculty be supportive of students during these trials and

Box 3: Zero to Thesis in 16 Weeks

Week	Class Meeting Topic	Deliverable	Revision
1	Thesis Outline	Outline draft	
2	Source Management Software + Literature Review	Annotated bibliography	Outline draft
3	Literature Review	Finalize literature review	Finalize relevant sources in the bibliography
4	Literature Review/Data and Methods	Begin the data and methods section	Literature review
5	Data and Methods	Finalize the data and methods section	Discuss progress on data and methods
6	Exploratory Data Analysis	Analysis/Results: Descriptive statistics	Data and methods
7	Preliminary Results	Analysis/Results: Inferential statistics	Discuss result interpretations
8	Results	Excel spreadsheet	Discuss result interpretations
9	Results	Finalize results	
10	Spring Break		
11	Introduction	Introduction	Results
12	Discussion	Discussion	Introduction
13	Limitations/Future Research	Limitations/future research	Discussion
14	Finalize Thesis Formatting	Formatted thesis	Limitations
15	Submit Final Thesis	Final thesis	Final thesis
16	Presentation/Poster	Presentation/poster	

*Formatting, grammar, and style will be addressed throughout the semester.

tribulations and continually be willing to pivot, as necessary. Remember that today's students may be your colleagues tomorrow and the future of our field—a little bit of encouragement and empathy goes a long way.

5 Program Assessment

The authors of this paper have worked with several honors students using this particular method. Each is unique and presents different opportunities and challenges. The feedback we have received from students has been overwhelmingly positive. They appreciate the structured approach with consistent meetings and weekly goals while having the opportunity to develop their ideas and opinions. If faculty mentors serve as facilitators and provide support and resources, students and faculty report that this approach is more than worthwhile.[7] It is also worth noting that 57 percent of eligible students approached by the honors coordinator in 2023 about doing a thesis chose to do so and are poised to graduate with high honors this semester.

It is vital that mentors must guide honors students to be successful. It is therefore important to identify when a student is on a successful or unsuccessful path. Fortunately, many of these challenges can be mitigated by a good honors coordinator. This service appointment is appropriate for someone with an undergraduate teaching appointment who has a passion for undergraduate research and a talent for connecting bright students with faculty members who match their research interests. Therefore, they are expected to be knowledgeable about the ongoing research and skills of the rest of the faculty. This allows for a more efficient matching between advisor and student, and limits the potential challenges and bottlenecks each pair may face.

It is unrealistic to expect all students who have a high GPA to engage in honors research and here may be warning signs that arise over the course of multiple semesters that a student might not be able to complete the honors research program. The characteristics of successful and unsuccessful honors students using this method are identified below (Box 4). These criteria are based on the experience of the authors when dealing with students and are beyond what an honors coordinator could identify. Faculty members should alert the honors coordinator quickly, should some of the listed struggles become apparent in the mentoring relationship."

6 Conclusion

Undergraduate honors programs in agricultural economics offer an array of benefits that extend beyond conventional education in the classroom. Their rigorous curriculum, problem-solving focus, and experiential learning components collectively empower students with a comprehensive skill set. This enables honors students to solve skilled problems as gifted researchers and become valuable contributors to the agricultural sector. As such, honors programs represent an invaluable opportunity for ambitious future agricultural economists to excel in their academic pursuits and thrive as professionals in the agricultural field, even if they were delayed in getting to these programs.

[7] A list of completed honors theses for the College of Agricultural and Life Sciences can be found at https://ufdc.ufl.edu/collections/ufhonors

Box 4: Successful v. Unsuccessful Honors Student Characteristics

Characteristic	Successful Honors Student	Unsuccessful Honors Student
Time Management	Effectively balances academic responsibilities, extracurricular activities, part-time employment, and personal commitments. Utilizes tools such as calendars, planners, and to-do lists to organize and prioritize tasks.	Struggles to meet deadlines and fulfill obligations due to poor time management skills. Procrastinates on assignments, leading to rushed work and subpar outcomes. Often feels overwhelmed by competing demands and responsibilities.
Resilience	Actively seeks out challenging courses, independent research opportunities, and internships related to their field of study. Demonstrates enthusiasm for learning and actively participates in class discussions and extracurricular activities. Learns from setbacks and failures, seeking feedback, and implementing strategies for improvement. Maintains a positive attitude and persists in the face of obstacles, demonstrating resilience and adaptability.	Displays disinterest in academic pursuits, frequently skipping classes and showing minimal engagement. May lack enthusiasm for coursework and be indifferent toward opportunities for intellectual growth or career advancement. Becomes discouraged by academic challenges or setbacks, often giving up without seeking assistance or feedback. Shows little resilience in the face of failure and may withdraw from difficult situations rather than persist.
Accountability	Takes responsibility for academic performance and behavior, meeting deadlines, and fulfilling obligations to the best of their ability. Seeks help when needed and acknowledges mistakes or shortcomings.	Shifts blame onto external factors or individuals, making excuses for poor performance or behavior. Demonstrates a lack of accountability by failing to take ownership of academic responsibilities or learn from mistakes.
Self-Discipline	Maintains a disciplined approach to studying and coursework, setting aside dedicated time for learning and adhering to a consistent study schedule. Demonstrates self-control in managing distractions and staying focused on academic tasks.	Exhibits a lack of self-discipline in academic pursuits, frequently procrastinating or succumbing to distractions. Struggles to establish and maintain effective study habits, leading to inconsistency in effort and productivity.
Reflection	Engages in regular self-reflection on academic performance, learning experiences, and personal growth. Seeks feedback from peers and mentors to identify areas for improvement and develop strategies for ongoing development.	Shows limited reflection on academic experiences or performance, often failing to recognize patterns or identify areas for improvement. May resist feedback or be unwilling to acknowledge shortcomings, hindering growth opportunities.

Throughout the proposed two-year program, emphasis is placed on project management, revision, and the research process. This proposed curriculum would be further bolstered by collaborative projects and group discussions, enabling students to learn from their peers and cultivate a diverse skill set essential for future careers in agricultural economics. By the program's conclusion, participants will have a better understanding of the complexities of agricultural economics and the types of contributions made by those in our field. In addition, they will have honed their critical thinking, research, and communication skills. Graduates of this honors program will be well-prepared to contribute meaningfully to the agricultural industry, whether as policy analysts, researchers, consultants, or advocates. In this way, we can ensure a bright future for our field even as our present is ever-changing.

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Acknowledgments: There are no conflicts of interest or data that involve human subjects in this manuscript. The authors appreciate the interest in our field of creating a pathway for future agricultural economists.

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DOI: https://doi.org/10.71162/aetr.692979

Teaching and Educational Method

Undergraduate Research Opportunities in an Applied Economics Program: Expanding Pathways for Economics Majors (and Beyond) at Land-Grant HBCUs

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JEL Codes: A22, I23, J24
Keywords: Applied economics, HBCU, in-class and out-of-class pathways, undergraduate research, UREs

Abstract
This article describes an intentionally designed two-pathway (in-class and out-of-class) framework for undergraduate students to gain research opportunities and analytical skills in an applied undergraduate economics degree program located in the Deese College of Business and Economics at North Carolina Agricultural and Technical State University (NC A&T), a high research activity Historically Black College and University (HBCU), 1890 land-grant university. This framework is being expanded across the Deese College, building on the success of past undergraduate research activities in the economics department. We summarize the design and pilot implementation of this framework that scaffolds hands-on research experiences and practical research skill development over multiple years, involving multiple stakeholders. The framework seeks to increase the number of underrepresented students engaged in applied research experiences and prepare students for a future that encompasses graduate studies and research-based employment.

1 Introduction

Undergraduate research prepares students with the skills, knowledge, and confidence needed for future academic and research-oriented opportunities (Russell, Hancock, and McCullough 2007). The National Academies of Sciences, Engineering, and Medicine Consensus Report, *Undergraduate Research Experiences for STEM Students: Successes, Challenges, and Opportunities* (National Academies of Sciences, Engineering, and Medicine 2017), provides a comprehensive summary of current knowledge regarding the impact of undergraduate research experiences (UREs) on science, technology, engineering, and mathematics (STEM) student learning, college success, career formation, and identity as researchers. As noted in the study, support for UREs in U.S. higher education has existed since the mid-1900s, but gained increased attention in recent decades as an important active-learning practice for improving undergraduate education. Specifically,

> *UREs have been proposed as an opportune way to actively engage students and may be a key strategy for broadening participation in STEM. Multiple reports have focused on the potential high impact of UREs and the often-limited availability of the experiences. These reports often call for an expansion in UREs to allow for greater access to a wider array of students. Current efforts are working to increase the number of students participating in UREs and to increase the diversity of those participants.* (National Academies of Sciences, Engineering, and Medicine 2017, pp. 1–2)

Undergraduate research experiences often occur outside of traditional classroom instruction, but increasingly they are also being integrated into undergraduate courses as course-based undergraduate research experiences (CUREs). In this paper, we describe a unique,

intentionally designed undergraduate research framework that includes both elements of undergraduate research as complementary, intentional pathways for students to engage with authentic research throughout the undergraduate curriculum.[1]

2 Responding to the Challenge: Expanding Undergraduate Research Experiences to a Broader and More Diverse Student Population

The setting for our undergraduate research framework is an applied undergraduate economics degree housed in the Deese College of Business and Economics (Deese College) at North Carolina Agricultural and Technical State University (NC A&T), an 1890 land-grant, doctoral, high research activity university, and currently the largest historically Black college or university (HBCU) in the United States.[2] The Deese College has more than 1,900 students, 87 percent of whom are Black, and 95 percent of whom come from underrepresented populations. Faculty in the Department of Economics are actively engaged in research across disciplines, often collaborating with scholars and stakeholders from different disciplines, local communities, and government agencies on research focused on local economic development, agriculture, land use, food safety and security, natural resources, and environmental economics. Due to both the nature of the program (an economics program in a business school at an HBCU) and strong alignment with applied economics topics, the pathways that we are developing are relevant to and can be applied to a wide range of applied economics programs.

The fact that this framework is being developed within an HBCU is particularly noteworthy given these institutions' track record of graduating Black students with STEM degrees and increasing Black representation in graduate education and STEM careers.[3] We aim to build on that legacy, expanding UREs outside of traditional STEM disciplines. HBCUs are known for providing supportive environments for student development, engagement, advocacy, and career opportunities. They generally exhibit greater faculty and student diversity than predominantly White institutions (PWIs), promoting a stronger sense of belonging, a component known to support persistence and retention (Tinto 1975). Multi-year undergraduate research programs such as the one described below both benefit from and foster that sense of belonging, building a virtuous cycle of support that promotes overall student success.

Undergraduate research experiences are not new to economics, but most research on their impact on student success focuses on just one aspect of these experiences, such as capstone course design (Li and Simonson 2016) or faculty-mentored student research (Wagner 2015; Cebula 2017; Gitter 2021). A notable shortcoming of existing efforts in undergraduate economics programs is the absence of an intentional framework scaffolding the research process for undergraduate students over multiple years. A structured, yet flexible, program promoting and supporting undergraduate student research throughout the curriculum, especially for students outside of traditional STEM fields, is important for providing research experiences to a larger and more diverse group of students. This is particularly valuable for students studying at HBCUs, where the research experiences not only directly benefit students but also marginalized communities where HBCUs are often located. The economic and social challenges of these communities can be incorporated into undergraduate research projects. We have not found any similarly structured undergraduate research initiative in economics programs at

[1] The authors include both traditional faculty-apprentice undergraduate research experiences and course-embedded undergraduate research experiences (CUREs) that are a formal part of undergraduate curricula—for example, capstone courses—in this paper. We use the URE acronym throughout unless specifically discussing course-embedded research experiences.

[2] The institution serves more than 13,000 students, 80 percent of whom are Black, 89 percent of whom have racial identities underrepresented in science, technology, engineering, and mathematics (STEM). The institution has a STEM focus and is the largest producer of Black undergraduates in both engineering and agriculture in the United States.

[3] For example, of the top eight institutions that graduate Black undergraduate students who ultimately go on to earn doctorate degrees, seven are HBCUs (U.S. National Science Foundation, https://www.nsf.gov/news/special_reports/announcements/081920.jsp).

other HBCUs.[4] The undergraduate research initiative described here addresses this gap and responds to the National Academies' call for expanding undergraduate research experiences to a broader and more diverse student population.

To be successful in meeting this challenge, we believe that it is essential to design a comprehensive and systematic undergraduate research framework that integrates multiple research opportunities into the undergraduate curriculum. Below we highlight a framework that includes two complementary "pathways" one in-class and the other out-of-class, that provide opportunities for undergraduate students to build research skills in a variety of areas (e.g., literature review, data cleaning, data analysis, scientific writing, and professional presentations) at increasingly higher levels within their undergraduate curriculum and engage in meaningful research experiences in partnership with faculty. The two pathways are complementary and together can expand the capacity of an undergraduate research program, engaging more students in authentic research. One goal of the program is to stimulate student interest in and preparation for graduate school and research-based or advanced employment. The latter is particularly important as stakeholders confront the shortage of diverse STEM workers to meet labor market demands (Wong et al. 2022). While our framework focuses on an economics department at a large-sized HBCU in the southeast United States, we believe the design can be readily adapted to other disciplines and schools. In fact, our previous departmental experience supporting undergraduate research (in a more ad hoc manner) is helping to inform a college-wide undergraduate research experience initiative that will not only increase economics department undergraduate research opportunities, but as discussed below, also expand those opportunities to all disciplines within the Deese College, with the potential for greater cross-disciplinary research collaboration.

3 The Importance of Undergraduate Research Experiences for Historically Underserved Students

While UREs are often discussed in terms of STEM education, Kuh (2008) highlighted the value of UREs as a research-supported "high impact educational practice" that has positive impacts for all students, not just those in STEM disciplines. More recent research supports Kuh's earlier findings and suggests that participation in UREs has multiple positive impacts on students: increased participation and retention in the major, higher rates of graduation, increased disciplinary knowledge, and deeper understanding of disciplinary culture. For historically underrepresented students, studies indicate that UREs have a disproportionate positive impact on degree completion, persistence in the discipline, and personal traits such as self-efficacy, sense of belonging, and identity in the discipline (National Academies of Sciences, Engineering, and Medicine 2017, Chapter 3). These results echo one of Kuh's (2008) key findings: "historically underserved students tend to benefit *more* from engaging in educational purposeful activities than majority students" (p. 17). However, "some groups of historically underserved students are less likely to participate in high-impact activities—those first in their family to attend college and African American students in particular" (p. 17). As noted above, efforts to expand these experiences (such as UREs) for underrepresented minorities has increased in recent years. The development of our complementary in-class and out-of-class URE "pathways" approach is designed to support this ongoing call to expand the availability of high-impact teaching/learning practices to underrepresented minorities and to students outside of traditional STEM fields.

The finding that UREs are particularly beneficial for African American students, especially those attending HBCUs, is not surprising. A key mechanism for creating impactful UREs is meaningful and effective faculty mentoring, a hallmark of HBCU learning environments. Emerson, McGoldrick, and

[4]According to https://hbcu-colleges.com/economics, there were 26 HBCUs offering economics bachelor's degrees at HBCUs in 2024.

Simkins (2023), summarizing research on the disproportionate impact HBCUs have on Black STEM majors and PhD production, highlight a variety of practices identified as helping HBCUs create "a safe, supportive, and nurturing environment for Black students to succeed" (p. 3). Such an environment is ideal for creating, implementing, and sustaining impactful URE programs.

UREs offer an opportunity to challenge academically high-performing HBCU students to put "classroom" knowledge to use developing novel solutions to complex problems while also drawing in students less enthusiastic about traditional "classroom" learning. UREs provide opportunities to engage in research on real-world problems that create a "need to know" foundational statistical, analytical, and communication skills—and motivate students to learn those skills. More generally, undergraduate research programs at HBCUs provide a critical opportunity for students to apply knowledge to problems and issues of interest to them, their communities, and society. We also believe minority student researchers are uniquely positioned to bring fresh perspectives to the research process that comes from their lived experiences, perspectives that can address shortcomings sometimes associated with research conducted by non-minority researchers. For example, a minority-oriented research lens brings heightened awareness to the determination of research samples and testing cohorts across demographic groups.[5] In addition, expanding undergraduate research programs at HBCUs across a wide-range of disciplines (including non-STEM disciplines) not only deepens the critical thinking and research skills of students but also aims to increase the number of minority graduates who go on to pursue research-grounded careers.

While UREs tend to be more prevalent in STEM disciplines, they are increasingly being incorporated in a wide variety of non-STEM disciplines, including business (Stößlein and Kanet 2016).[6] In economics, interest in developing undergraduate research skills dates to the early 2000s, with emphasis (as noted earlier) on CUREs and capstone experiences in the discipline. Opportunities for undergraduate economics students to present their research at regional and national economics conferences has increased in recent years (Deloach 2023), further increasing interest in UREs in the discipline. The *Starting Point: Teaching and Learning Economics* online pedagogic portal (https://serc.carleton.edu/econ/studentresearch/; see also Maier, McGoldrick, and Simkins 2012) includes a comprehensive set of resources promoting UREs in economics as an evidence-based pedagogy, including ways to engage undergraduates in research and examples of a wide range of UREs in economics. Since 2010, several articles have been published on the role and structure of effective UREs in economics (see, for example, Deloach, Perry-Sizemore, and Borg 2012; Hoyt and McGoldrick 2017a), including a multi-paper symposium in the *Journal of Economic Education* (Hoyt and McGoldrick 2017b).

To summarize, UREs are a demonstrated "high impact practice" for improving a variety of student outcomes across a wide variety of disciplines, including economics. Research consistently illustrates that UREs are particularly impactful for underrepresented minorities, promoting higher graduation rates, persistence in the discipline, and increased learning of skills and practices in their fields, along with improved self-efficacy and identity as researchers. Ultimately, this personal and academic success leads to greater representation of historically underserved populations in research-based jobs and graduate programs. The development of our two-track URE program in economics is both motivated by and

[5] These types of issues are often important in STEM research; for example, face recognition technology related to artificial intelligence and machine learning (Buolamwini and Gebru 2018), pharmaceutical drug testing (Boyle 2021), and social science research anchored in "appropriate" research questions and populations for study (Sue 1999).

[6] In a series of articles, the *Journal of the Scholarship of Teaching and Learning* published a special issue on undergraduate research in May 2021 (Vol. 21, No. 1; see https://scholarworks.iu.edu/journals/index.php/josotl/issue/view/2101), highlighting the transformative power of undergraduate research across a wide variety disciplines. In that issue, Fischer et al. (2021) provides a comprehensive taxonomy for developing high-impact undergraduate research experiences, regardless of discipline.

grounded in these research findings. Benefits accrue not only to the students involved, but also to society.

4 Undergraduate Research Experiences: A Two-Pathway Framework

The integration of research skill development and undergraduate research experiences within the economics curriculum plays a vital role in preparing the next generation of economists, scholars, and decision-makers. These research experiences bridge the gap between economic theory and real-world challenges, allowing students to apply economic concepts learned in a traditional classroom setting to practical problems in the world. Many departments of economics and applied economics have incorporated various research opportunities for their undergraduate students. It is especially prevalent in programs that emphasize applied economic research, where students may have opportunities to engage in research through faculty-mentored research projects (often as paid undergraduate researchers funded through faculty grants from the U.S. National Science Foundation (NSF), U.S. Department of Agriculture (USDA), or other federal agencies), credit-based independent study courses, or undergraduate Honors theses.[7] In the past two decades, CUREs have also increasingly been used to engage undergraduate students in semester-long applied research projects completed within a course. CUREs developed to expand the benefits of more traditional faculty-mentored undergraduate research experiences to a broader group of students.

In the sections that follow, we describe an intentionally designed framework that innovatively combines the two methods in one framework, including in-class and out-of-class pathways. The framework is illustrated in Figure 1, which highlights the complementary and mutually reinforcing nature of the two pathways. Each year students participate in multiple activities from each pathway, typically including a standard economics course, a faculty-led project, and a university research workshop. The course and university research workshops are strategically designed to support the faculty-led projects. Because of this design, a particular strength of the framework is that there is a robust, built-in retention mechanism: once students engage in the two pathways, they experience spiraling growth in their research capabilities, which increases the likelihood that they will continue to follow through with the faculty-mentored project over multiple semesters, at increasingly higher levels of complexity. One expected outcome from this approach is that students will ultimately be able to independently carry out high-level research, supported by faculty mentoring, and use these research experiences to successfully compete for corporate, governmental, and non-profit research-related positions, as well as graduate school admission in economics, public policy, and related programs.

5 The In-class Pathway—An Intentionally Aligned Program Curriculum

The *in-class pathway* illustrated in Figure 1 serves as the foundation of our undergraduate research framework, with an intentionally designed core series of courses that introduce, reinforce, and apply statistical analysis and data visualization in the context of applied economics research. In addition to standard introductory and intermediate-level micro- and macroeconomic theory courses and applied electives, our current economics curriculum includes three statistical methodology courses and culminates in a senior capstone course where students are tasked with undertaking a data-driven research project. As part of the intentional college-wide undergraduate research framework we are building, we also plan to add a first-year seminar course that will serve as an introduction to the major and economic research. Our curriculum is aimed at developing students' statistical, research, and communication skills to prepare them to independently and effectively conduct applied economic

[7] The National Science Foundation has developed a specific program to promote undergraduate research, the Undergraduate Research Experience (NSF-URE) program, which aims to provide research opportunities for undergraduate students, typically during the summer months between academic years.

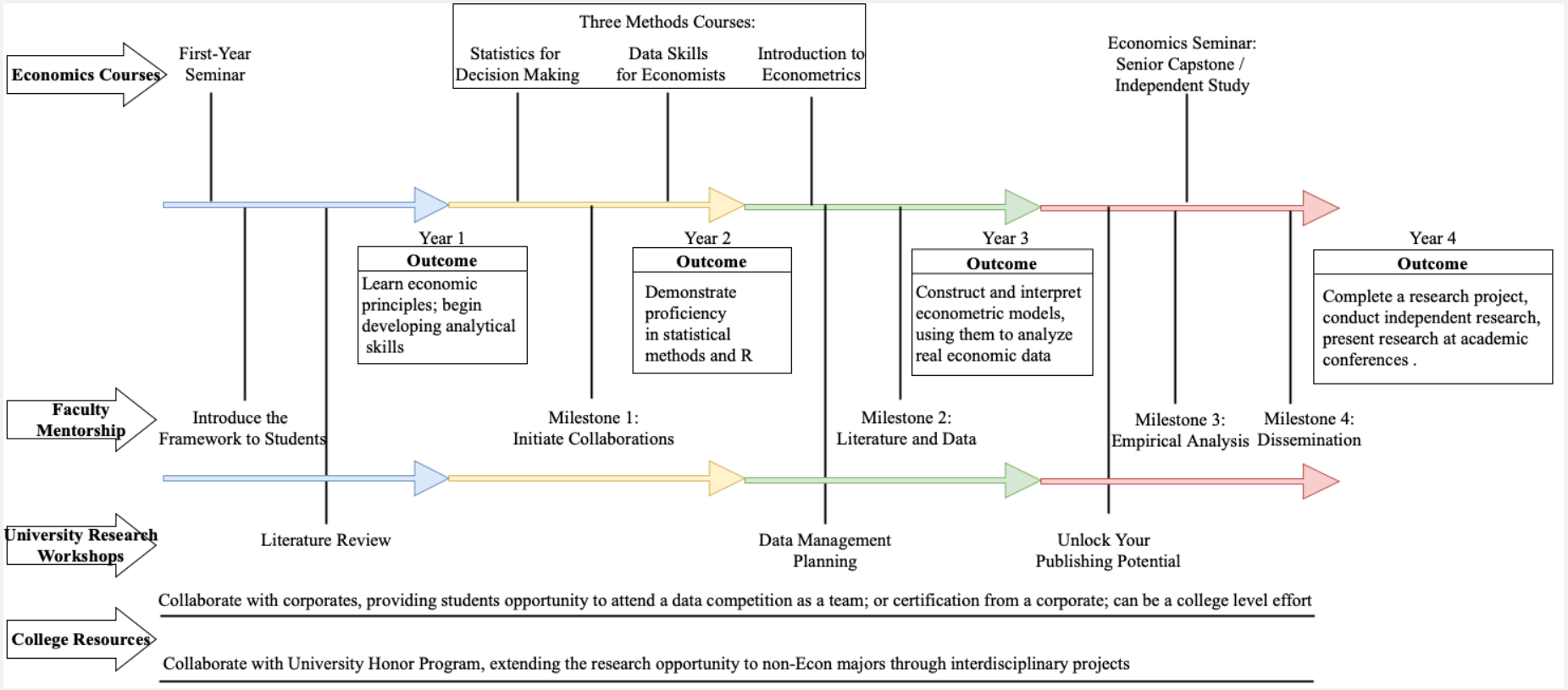

Figure 1: The Two-Pathway Framework.

research and communicate the results to an appropriate audience. The key components of our in-class undergraduate research pathway are described in more detail below.

5.1 First-Year Seminar

This seminar, *Introduction to Economics: Principles and Applications*, part of the broader college-wide initiative to promote undergraduate research, is being designed as a one-credit course for incoming first-year students and will be co-taught by multiple economics faculty members. The objectives of this course are to provide a high-level overview of how economists apply economic theory and models to real-world issues, identify common student-faculty research interests, and establish potential student-faculty mentorship relationships. Faculty members in the department will introduce their ongoing research projects and discuss the research tools economists use to analyze real-world economic problems. By the end of the course, students will be encouraged to identify and connect with a faculty member whose research interests align with their own. The ultimate goal is to create opportunities for faculty mentoring and student collaboration on a research project that can grow in breadth and complexity over the student's undergraduate career.

5.2 Statistical Methodology Courses (Skill-Building and Reinforcement)

The economics curriculum includes three statistical methodology courses central to undergraduate research proficiency:

- *Statistics for Decision Making* is an introductory level statistics course, typically taken in students' first semester of their sophomore year. Statistics plays a foundational role for undergraduate students conducting research in economics. In the realm of applied economics, data-driven analysis is fundamental; proficiency in statistics allows students to use the necessary tools to analyze, interpret, and draw meaningful conclusions from real-world complex data sets.
- The second course, *Data Skills for Economics*, immediately follows the introductory statistics course and introduces R programming skills necessary for statistical analysis, data visualization, and econometric modeling. The course reinforces basic statistical skills while building R programming competency. Proficiency in R has become a critical skill for undergraduate students doing research in economics and serves as a tool that links theoretical concepts in economics to empirical, data-driven analysis.
- The third course, *Introduction to Econometrics*, is designed for junior economics majors, requiring both *Statistics for Decision Making* and *Data Skills for Economics* as prerequisite courses. This R-based course teaches students to build econometric models to analyze real economic research questions using actual applied economics data sets.

These three statistical methodology courses intentionally scaffold students' statistical, programming, and research skills over three years, building their statistical research capabilities and developing methodological rigor, both of which are key to applied economic research. These courses serve as the foundation for the capstone course in the major, which requires students to carry out a real-world data-based research project.

5.3 Course-based Research Projects (Applied Research on Real-World Issues, Capstone Course in the Major and Independent Study Course)

Previous study focusing on undergraduate research has documented the importance of CUREs (Siegfried 2001; Santos and Lavin 2004). In our framework, we introduce two course-based opportunities for students to conduct authentic research: (1) the required senior *Economic Seminar* course, which serves as a capstone course in the major (see Li and Simonson (2016) for the value of having a capstone course

in an economics curriculum), and (2) a major-based *Independent Study* course, which can be used as an economics elective course in the major.

The *Economic Seminar* course is taught as an economic research seminar. At the beginning of the semester, students are given assignments on a common research topic, such as analyzing land use implications from changing crop prices, and are provided with data sets enabling the analysis of the research topic for one geographic region per student. Relevant data analytics and research methodology topics are reviewed and/or introduced and mastered in lectures and classwork and are assessed in two midterm exams. Data manipulations, calculations, and analyses needed for the research projects are carried out as graded homework assignments. The individual research projects culminate in the development of student posters presented at the end of the course, with the posters and presentations contributing a significant portion to the overall course grade. Assessment data from the course, drawn from exams and the research posters, also contribute to the Southern Association of Colleges and Schools (SACS; a regional accreditation) economics program assessment.

In addition to the Senior Economics course, we also offer a three-credit *Independent Study* economics course that can be arranged between a faculty member and a student. While this course has not been widely used in the past, it provides students with a flexible mechanism to conduct research on faculty-led projects that align with the student's research interests and career goals. With the successful completion of the foundational in-class pathway of courses, students are well-prepared to conduct faculty-mentored research in the Independent Study course. We anticipate greater use of this course as an economics elective course (two are required in our current degree program) as the Deese College begins to fully implement a college-wide undergraduate research program.

6 The Out-of-Class Pathway—Faculty-Mentored Student Research Experiences

The *out-of-class pathway* in Figure 1 emphasizes students working collaboratively with faculty on research projects funded either through external grants or through a new Deese College Undergraduate Research Experience (DCURE) initiative, now in its initial pilot phase. The DCURE facilitates faculty-mentored and mutually agreed-upon undergraduate research projects. The DCURE program plays a key role in the out-of-class undergraduate research pathway presented here and complements, rather than replaces, traditional external grant-funded UREs, which have played a central role in the economics department in the past. As illustrated in Figure 1, the program incorporates not only faculty-mentored undergraduate research projects but also student research skills workshops led by University Library staff. The success of the program relies on several interacting layers that involve corporate partners, faculty, students, administrators, and other units on campus. In the paragraphs below, we describe key elements of this program, which is currently in its early stages of implementation.

6.1 Corporate Partner Support

The DCURE program is being piloted college-wide, supported by financial investment of corporate partners, with the goal of significantly expanding undergraduate research opportunities both within and beyond the economics department. Corporate funding will be used to fund student researchers and faculty mentors. The Deese College has an extensive list of corporate partners who provide ongoing financial and in-kind support for students, faculty, and programs through formal multi-year agreements. One or more corporate partners will be responsible for providing direct financial support for this program. Why would corporate partners agree to fund this program? The DCURE program is an opportunity for the corporate partner to increase brand recognition and to gain early access to student researchers from a diverse talent pool. The skills learned in this program are transferable across a wide variety of jobs and business types and corporate partners will be able to see the results of their investment directly via Deese College research symposia.

Successful students in the program, designated as Company-Branded Scholars, will have inside access to corporate internships and job placements. In the best-case scenarios, corporate partners will provide real-world data that allow the student researchers to create value-added solutions to corporate challenges or explore potential profitable business opportunities. Student researchers will be paid the university's hourly work-study rate and faculty mentors receive a nominal mentoring stipend; the initiative will also provide student and faculty support for software, equipment, technical training, conference travel, and publication fees, as well as professional certifications (e.g., business analytics).

6.2 Matching Student and Faculty Researchers

A key component of our approach is the process of matching undergraduate researchers with faculty projects. This process relies in part on a catalog of faculty-developed research topics tailored to align with various career paths in the college (and faculty research interests). This approach not only ensures that students are engaged in projects of personal interest but also promotes the development of relevant skills for in-demand jobs related to students' majors and provides a broad array of research opportunities for undergraduate research scholars in the Deese College. We view the DCURE program as a valuable avenue for expanding economics UREs beyond traditional faculty grant-funded opportunities.

There are multiple ways to match faculty with students for a URE (Fenn et al. 2010). Siegfried and Walstad (2014) and Hoyt and McGoldrick (2017a) emphasize that Honors programs have become an increasingly common way to promote undergraduate research. The Deese College is in active discussion with the Honors College to develop a formal partnership promoting undergraduate research opportunities for Honors students outside of traditional STEM fields (in particular, students in the Deese College). Honors students currently have the ability to do additional work in traditional undergraduate courses to receive Honors course credit. However, while some faculty have been able to create meaningful course-based research projects for students, it is challenging given the one-off nature of these experiences and the lack of an external administrative structure to support this practice. The DCURE program is intended to address these challenges by providing a comprehensive out-of-class framework promoting and supporting faculty-mentored undergraduate research in a variety of disciplines, including economics.

Faculty Participation. Faculty are asked to denote their interest in participating in undergraduate research via a survey link. Consideration is given to faculty who have established research projects and share the overall goals of the DCURE program. Program goals account for the needs of students, faculty, administrators, as well as corporate partners. Faculty-student research teams willing to apply their research training and expertise to problems that align with the corporate sponsor's mission are desired, but not required. The mentorship aspect of the faculty advisor is heavily emphasized in the solicitation announcement to signal the priority on nurturing student research development.

Student Participation. Similarly, students are given the opportunity to express their interest to participate via a survey link. Students that meet a threshold cumulative GPA (3.3 or higher) are sent the survey application requesting their contact information, major, classification, a description of previous research experience if applicable, their research interests, and reasons for wanting to be in the program. The program is designed to recruit students early in their undergraduate careers (e.g., just prior to sophomore year) and create support structures to encourage their persistence in the program. Students can take a newly created college-based one-credit hour undergraduate research course (repeatable up to three-credit hours) or a department-based three-credit independent study course, if available. These choices are decided in consultation with the faculty advisor.

Faculty-Student Matching. The college leadership team (department chairs, associate and assistant deans, and dean) provides input on faculty applicants to help with the selection. Once faculty are identified, they are provided the opportunity to review student applications and identify and rank their student selections. Faculty members selecting the same student can agree to co-mentor the students or determine the best faculty match for the student's major, background, and expressed interests. Faculty mentors take part in mentorship training to learn effective mentoring strategies that help students learn more successfully.

6.3 University Library Collaboration—Undergraduate Research Workshops

The economics department, in conjunction with the Deese College of Business and Economics, will also collaborate with the University Library to create and implement a series of research-focused workshops for students. These workshops are designed to target the undergraduate students who have started or are interested in working on faculty-mentored research projects, aiming to enhance basic research skills such as conducting literature reviews, sourcing and obtaining data, preparing for conference presentations, and writing for publication in peer-reviewed journals.

6.4 Expanding Dissemination of Student Research

In their senior year, students will be encouraged to showcase their work publicly, both internally and externally. In the recent past, economics students have presented both their senior capstone course research and out-of-class research projects at the university's annual Undergraduate Research Symposium and the state-level Undergraduate Research and Creativity Symposium. Both venues expose participating students to peer research in economics and other disciplines. Undergraduate research assistants that have worked on externally funded research projects in the economics department have also attended and/or presented at regional or national research meetings and conferences, but such opportunities have been limited by lack of adequate financial support. The DCURE program will provide additional funds to send a larger number of students to external meetings and conferences. The department is also currently exploring collaboration with regional universities to create more low-cost dissemination opportunities for undergraduate economics research with minimal travel.

6.5 Summary—Out-of-Class Pathway

Given the complexity of nurturing student research skills, the two-pathway framework described above is designed to both expand and deepen undergraduate student research experiences in the economics department and college-wide in an intentional and systematic way. The in-class portion of the program takes advantage of intentionally designed courses to introduce and solidify foundational research skills with students. The out-of-class portion utilizes faculty mentorship, along with college, university, and corporate partner-level assets that provide additional focused training and support for students. This scaffolded approach is most effective when students are integrated into the program and introduced to a faculty mentor early in their undergraduate career. Sustained support over time is required to help students develop a robust set of research skills and competencies that can define knowledge gaps, identify and summarize background information and literature, formulate a hypothesis or scientific question, create and implement a research design, collect and analyze data, and then write and present study findings for appropriate audiences. This process requires ongoing, intentional mentorship, resources, and stakeholder commitment, central to the design of the two-pathway undergraduate research framework we are initiating.

7 Motivating Student and Faculty Participation in UREs

Implementing this undergraduate research framework demands considerable effort and resources, but the potential benefits to students and the institution are considerable. Building in effective strategies to

motivate ongoing faculty and student participation and engagement, with respect to out-of-class research opportunities, is key to its long-term success. This occurs in multiple ways. For example, the exposure of students to the broader applications of economics helps them develop interest in graduate school and/or employment that they may not have previously considered. We have an example of two undergraduate research assistants in the economics department, who after participating in a computationally intensive research project, chose to complete a master's of science in data analytics degree and are now successfully employed in computationally intensive roles in the private industry. In another case, an undergraduate research assistant who was considering several career options after completing his undergraduate economics degree successfully competed for a highly competitive Research Assistant position at a regional Federal Reserve Bank and two years later entered a graduate program focusing on economic policy.

To motivate student participation, we initially emphasize the benefit that research opportunities can offer, both academically and professionally, in the *First Year Seminar*. In addition, we provide training and workshops focused on enhancing empirical and analytical skills, communication skills (including data visualization and professional writing skills), and presentation skills, making the research and dissemination process less intimidating (and broadly transferable) for students. We also offer a platform for sharing student research with a broad audience, where students can showcase their work and skills in ways that can be highlighted in job interviews and graduate school applications—and direct contact with corporate partners funding their research experiences. Finally, as a financial incentive, the DCURE program offers a monetary stipend to students who are paired with a faculty member on a research project.

As we have done in the past, we strongly encourage faculty members to include undergraduate researchers in research grants from foundations and governmental agencies such as the NSF, National Institutes of Health, USDA, Department of Energy, Department of Defense, U.S. Forest Service, and others. Our experience so far from faculty grant-funded undergraduate research experiences is that this combination of incentives is enough to motivate a small but dedicated set of students to engage with faculty on mentored research. A challenge in expanding this in the past has been the lack of financial resources to support student stipends and travel to conferences more broadly. With the expansion of these opportunities through the DCURE program, we anticipate scaling-up faculty-led UREs, both in the economics department and across the college. We are currently in the early phases of piloting this program.

A particularly promising, but initially challenging, extension of the out-of-class pathway is to incorporate undergraduate research assistants as part of a broader research team, including faculty members, postdocs, and graduate students, following a common STEM model, especially in the sciences. The integration of undergraduate researchers in such collaborative teams provides extended and lasting benefits to the students and reduces the individual time commitment of a mentoring faculty mentor. In addition to gaining expertise from the faculty member overseeing the team, undergraduate researchers gain valuable knowledge from graduate students and/or postdocs on the team, both in terms of direct research skills and on-the-ground experience with graduate-level research activities. Our experience has shown that purposeful orientation of undergraduate research assistants, maintenance of open communication, and developing a clear understanding of attribution of credit are imperative for success. All of these occur more regularly when undergraduate researchers regularly interact in an "apprenticeship" role as part of a broader, multi-level research team. Our previous interactions with interdisciplinary research teams also demonstrate the advantages of shared physical spaces (e.g., chemistry labs in STEM fields) for nurturing productive within-team connections. Such shared spaces allow for day-to-day interactions between researchers and help undergraduate students better understand and integrate into the research environment. The Deese College is planning for the development of such a multidisciplinary research-dedicated space as a key component of the DCURES program.

Why are faculty members motivated to participate? After all, the need to manage individual undergraduate researchers or larger research teams can be challenging. Faculty mentors need to devote focused effort to creating a welcoming and productive environment for undergraduate research assistants who will likely be new to formal research experiences and require training in both general research practices and specific skills (such as coding for statistical tools such as R). Collaboration in interdisciplinary teams requires even stronger team-building skills from faculty mentors, including establishing common, standardized vocabulary and understanding the scope, limitations, and assumptions of economic modeling (Liang et al. 2021). Despite these challenges, the economics department in the Deese College has a history of supporting a limited number of undergraduate researchers through government-sponsored faculty grants, both during the academic year and in summer, as noted above. Faculty members who have led these efforts pride themselves in mentoring future researchers and seeing students grow their skills beyond their classroom training. More pragmatically, these students provide essential research support to faculty members, assisting with literature reviews, data cleaning, and statistical analysis. Mentoring undergraduate student researchers takes time and effort, but in our experience, faculty mentors have found a significant return on that investment in the form of additional professional presentations and publications.

In the best cases, undergraduate researchers work alongside graduate students, just as in more traditional STEM lab environments. While we do not have a graduate program in our economics department, some of our faculty serve as dissertation advisors or committee members for students in related interdisciplinary fields. Incorporating undergraduate researchers into this work provides another opportunity for undergraduate researchers to gain valuable direct as well as indirect research skills and values in an organic way, further diffusing the impact of the faculty member across multiple academic levels. Using the positive economics department experience with undergraduate research as a guide, the DCURES program aims to scale these faculty experiences college-wide to promote research grant funding (that incorporates undergraduate research experiences), increase research publications, and increase the graduate school pipeline of underrepresented students.

8 Summary

Undergraduate research experiences in applied economics play an essential role in developing students' analytical skills. They promote and advance students' abilities to think critically, carefully analyze relevant data, draw evidence-based conclusions, and effectively communicate results to relevant audiences, valuable skills that reinforce and synthesize classroom learning. Furthermore, these analytical skills are transferable, benefiting students in various career paths, including industry-focused research, policy analysis, and business consulting to name just a few.

This paper describes the development and pilot implementation of a systematic, intentional, and complementary two-pathway undergraduate research framework aimed at providing students in a College of Business and Economics in a large, research-intensive, land-grant HBCU with expanded research opportunities spanning a variety of disciplines, including applied economics. The college-wide DCURES program builds on the experience of the economics department in providing UREs to a limited number of students via grant-funded faculty research projects in recent years, as well as the department's course-embedded research in the senior economics capstone course. These experiences, jointly, have been valuable for the students involved, leading to nationally competitive research-based job placements and graduate school admission (and completion). More generally, the two-pathway DCURES program also responds to the National Academies' call for expanding undergraduate research experiences to a broader and more diverse student population.

The DCURES program is an attempt to expand the scope and impact of undergraduate research experiences both within the department and across the college through a framework grounded in two complementary—in-class and out-of-class—pathways and the collaborative efforts of the faculty,

students, college, and corporate partners. The program has been designed to meet the diverse needs of undergraduate students, enhance their research capabilities, and prepare them for future academic and professional careers in applied economics and related fields while advancing the strategic goal of the university and college to expand undergraduate research opportunities as a high-impact student learning practice.

The implementation of this systematic framework through the DCURES program is expected to play a transformative role in the college, and particularly in our economics department, by institutionalizing, expanding, and financially and administratively supporting what the department has been doing previously in an ad hoc manner. The integration of UREs in undergraduate education has been shown to positively impact student learning and success; the impact is disproportionately positive for underrepresented minorities. Increasing undergraduate research experiences at HBCUs outside of traditional STEM areas, as this initiative aims to do, has the potential to significantly impact the number of underrepresented minorities involved in applied economics research, along with the type of research carried out by these researchers. A well-structured, college-wide undergraduate research program not only enhances economics students' understanding of economic theory and builds key career skills, it also leads to a richer, multidisciplinary understanding of economic and social issues affecting underrepresented communities and the development of research-informed solutions that can address those issues.

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Acknowledgments: Research reported in this paper was supported by the National Science Foundation under Awards Number 2200648 and 1719498, Looking Forward program between UNC-Chapel Hill and NC A&T State University (Fund Number 136069), and the Agricultural and Food Research Initiative Competitive Program of the USDA National Institute of Food and Agriculture, grant number 2021-67021-34152, and the Department of Energy Award Number DE-FE0032483.

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DOI: https://doi.org/10.71162/aetr.834187

Teaching and Educational Commentary

Faculty Perspectives on Engaging Undergraduates in Agricultural and Applied Economics Research

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JEL Codes: A11, A22
Keywords: High-impact learning, Mentorship, Student Outcomes, Undergraduate Research

Abstract
Preparing the next generation of agricultural economists is critical to providing solutions to the numerous challenges faced within agriculture. Although undergraduates benefit from undergraduate research (UR), there is limited understanding of why and how faculty incorporate undergraduates in their research programs. To examine this issue, this study seeks to increase: (1) understanding of the motivations, (2) perceived support for, and (3) anticipated outcomes of agricultural economists who engage in UR. Based on an online survey distributed to U.S. faculty, results provide a perspective of the motivations of research mentors to engage in UR, prevailing advising models, and objectives, and perceived positive externalities to the field of agricultural economics. Intrinsic and extrinsic motivations may play an important role in faculty willingness to provide UR opportunities. Additionally, institutional bodies can alleviate the difficulties researchers face when engaging undergraduates, thereby increasing the overall interest of faculty and students in agricultural and applied economics to engage in research.

1 Introduction

Numerous studies have documented the benefits of undergraduate research (UR) (Ahmad and Al-Thani 2022; Buchanan and Fisher 2022). For an undergraduate student, engagement in a well-defined research project helps to develop their critical thinking skills (Ishiyama 2002; Brownell et al. 2015), thereby promoting higher-order learning outcomes (Brownell and Kloser 2015), such as creating new knowledge (Byars-Winston et al. 2015). Engaging with a faculty member in research also has added benefits; for example, it improves the undergraduate's collaboration (Ruth, Brewis, and SturtzSreetharan 2021) and communication skills (Kilgo, Ezell Sheets and Pascarella 2015), and can increase student retention (Johnson and Knox 2022).

For the faculty member, benefits include improved quality of work, personal satisfaction (interpersonal gains), and contribution to the faculty's research agenda (Zydney et al. 2002; Adedokun et al. 2010). Faculty members with research activities, including those with research roles and responsibilities as part of their formal university appointments, can be more familiar with changes in their development (Marsh 2007) and, thus, could lead to opportunities for collaborative partnerships with undergraduates. Furthermore, an environment where a greater proportion of faculty members found UR to be of higher importance was linked to increased student participation in UR (Webber, Nelson Laird, and BrckaLorenz 2013). For the university, benefits can accrue in the form of increased visibility in the scientific community from publications, abstracts, and presentations (Petrella and Jung 2008). Beyond personal growth and potential career exploration, participating in UR can augment job readiness and productivity through enhanced skills in problem-solving, analytics, attention to detail, adaptability, and time management relative to some conventional classroom offerings. These skill-enhancing activities coincide well with evolving employer preferences for more problem-solving capabilities relative to traditional grades as job performance indicators (National Association of Colleges and Employers 2022).

Beyond industry-oriented career preparation, UR can also prepare students for graduate degree programs by developing research skills and gaining a stronger understanding of the research process. For example, students mentored toward overcoming the rigors of the peer-review process and successfully publishing an article in a journal demonstrates a high degree of commitment to the research process and their discipline. Students who participate in UR also have a stronger sense of self-confidence and independence (Laursen, Seymour and Hunter 2012). Students with scholarly writing or presentations are generally more desirable and more competitive candidates for limited funded research assistantships. Moreover, many top economics programs support participation in UR (Hoyt and McGoldrick 2017).

On the other hand, educators face competing priorities for limited time and resources which can (1) obscure the value of engaging in UR, or (2) they may not consider the UR engagement as well-supported at their institution or by colleagues. In the field of agricultural economics, most research has focused on the benefits of UR to the students (Bampasidou et al. 2016; Penn and Sandberg 2018). However, little is understood about faculty motivations to increasingly engage in UR within the agricultural and applied economics discipline. While UR is a "high-impact learning activity" (HIP) that benefits undergraduates, these activities require intense effort by both faculty members and students (Bampasidou et al. 2016). There is also a "fundamental tension" between producing publication-worthy research and student development (Laursen 2015). This begs the question of (1) what motivates faculty mentor UR and (2) how to increase engagement in UR engagement. To examine this issue, this study seeks to (1) increase understanding of the motivations, (2) assess perceived support for, and (3) anticipate expected outcomes of agricultural economists who engage in UR.

This commentary reports the survey results of a sample (n = 48) of agricultural economists to understand the motivations, perceived support for, and anticipated outcomes of agricultural economists who engage in UR. The survey was designed based on previous literature to assess multiple facets of faculty perspectives and attitudes, including their motivations for engaging undergraduates, barriers to success, and student outcomes. Preliminary findings suggest that there are numerous reasons why faculty perceive that they should engage in UR/HIP, but substantial barriers exist beyond the control of faculty members.

2 Methods

To understand mentors' attitudes and rationale for advising UR, a survey was conducted beginning in March 2022 through Fall 2022 via Qualtrics (see Appendix 1). A review of prior literature provided initial guidance on survey design on relevant factors among faculty of UR mentoring. As such some questions were created, based on the findings from past studies, related to research advisors' motivations, including intrinsic and extrinsic motivations (Hayward Laursen, and Thiry 2017), benefits and outcomes of UR (Hayward et al. 2017), and the diversity in types of UR relationships between student and faculty (Matthews et al. 2019; Morales, Grineski and Collins 2021). The survey underwent several rounds of revision based on feedback from undergraduates, graduate students, and faculty, both with and without UR advising experience. The University of Florida Institutional Review Board (IRB) reviewed and determined that the survey and associated outreach materials were exempt (IRB202200390). Participants were recruited through listed contact personnel by institutional administrators, such as college deans, department heads/chairs, and faculty members. Contact information from publicly listed university, college, or department directories was used, and those in the academic profession were encouraged to share information about the survey questionnaire/data collection effort with other faculty to increase faculty member participation in the study.

The survey instrument asked respondents about their demographic and institutional characteristics, their experiences in working with undergraduate students (both one-on-one and in-classroom settings), methods of engaging and recruiting student researchers, and the perceived benefits

of UR both to themselves and the students. Most questions relied on five-point Likert-type responses in terms of importance ("Not at all" to "Extremely") and frequency ("Never" to "Always"). The statistical analysis relied on basic statistical tests for patterns in the data such as Fisher's exact test and Wilcoxon sign-rank tests.

3 Results

Of the seventy-two survey responses collected, forty-eight were usable responses (67 percent) with the remainder removed due to incomplete responses (Table 1). Our sample represents mostly faculty from agribusiness and agricultural economics departments (71 percent) largely from medium-sized (eleven to thirty faculty) or large-sized (thirty-one to fifty faculty) departments (83 percent). Nearly all respondents (96 percent) have graduate programs with just under half of the sample having more than 250 students (43 percent). Almost all our sample has engaged in UR extensively (94 percent) with 71 percent engaging three or more undergraduates in one-on-one research and almost half in course-based research. Most respondents mentor UR in the fields of agribusiness economics and agricultural policy. There is a mix of research-dominated (39 percent) and teaching-dominated (34 percent) appointments. Most respondents perceived a low level of support at all levels, but especially at the association level which only 5 percent felt supported UR. The remaining results appear in three sections: factors impacting participation in UR, anticipated benefits and outcomes of UR, and limitations and barriers to engaging in UR.

3.1 Factors Impacting Participation in UR

We conducted a series of Fisher's exact tests to determine which factors have codependences to UR engagement for one-on-one and course-based research (Table 2). Faculty size, appointment, and undergraduate program size were evaluated and found to be independent of, or unassociated with, UR advising. One reason is potential self-selection bias; faculty who care about UR were more likely to take the survey, regardless of their undergraduate enrollment. However, there is evidence of a relationship between perceived support with UR. Department, college, and university support activities have statistically significant relationships with UR advising.

3.2 Factors Affecting Decisions to Mentor Undergraduates

We measured factors affecting the decision to mentor a particular student. Faculty are foremost interested in the student's talent, placing priority on the student's motivation ($\mu = 4.6$, $\sigma = 0.58$) and intellectual curiosity and critical thinking ($\mu = 4.5$, $\sigma = 0.69$; 1 = not important at all, 5 = extremely important). Conversely, other factors like GPA, speaking skills, experience with statistical software, and the student coming from an underrepresented background all averaged between 2.3 and 3.0 (Figure 1).

3.3 Valuing UR Engagement

Faculty generally do not view UR as being valued (1 = not at all valued, 5 = very highly valued) at the discipline level (2.31), with only slightly more value being perceived from the department and college (2.75) or university (2.63). The respondents also indicated a lack of support at all these levels. Overall, 68 percent feel supported at the department and university level while 89 percent feel unsupported at the association level. It is worth noting, however, that regional and national associations do invest resources in activities, such as academic bowls, to support student engagement, pointing to a potential gap related to UR.

3.4 Benefits of Engaging in UR

When asked about the benefits of UR to the mentor, 90 percent selected personal fulfillment while approximately 48 percent mentioned an increase in research output. Mentors likely care more about the

Table 1: Descriptive Statistics of Survey Respondents (n = 48).	
Variable	**Frequency**
One-on-One Research	
Less than 1	6%
1	10%
2	13%
3+	71%
Course-Based Research	
Less than 1	46%
1	4%
2	8%
3+	42%
Faculty Size	
Less than 10	15%
11–30	63%
31–50	21%
50+	2%
Undergraduate Enrollment	
Less than 50 Students	0%
51–150 Students	25%
151–250 Students	27%
251–350 Students	15%
350+ Students	29%
Not Sure	4%
Majority Appointment	
Extension	20%
Research	39%
Service/Administrative	7%
Teaching	34%
Perceived Support	
Department	15%
College	21%
University	19%
Association	5%

enrichment they experience in activities that support student development. Less important were professional advancement (15 percent) or networking benefits (19 percent). Statements such as "paying it forward," "self-fulfillment," "mentor experience," and "advancing diversity of future researchers" all rated highly with mean scores of 3.4–3.7 (on a Likert scale of importance; Figure 2). Tangible outputs such as research or Extension publications were both relatively unimportant (2.0), though faculty do believe that a poster/presentation (2.4) and recruiting (3.3) are more important factors.

Table 2: Results of Fisher's Exact Tests

Variable	*p* value
Departmental Characteristics	
Faculty Size x One-on-One UR	0.796
Faculty Size x Course-Based UR	0.932
Undergraduate Enrollment x UR	0.088
Faculty Appointment	
Extension Appointment x UR	0.726
Research Appointment x UR	1.000
Service/Admin Appointment x UR	0.684
Teaching Appointment x UR	0.215
Respondent's Perceived Support	
Departmental Support x UR	0.075
College Support x UR	0.009
University Support x UR	0.036
Association Support x UR	0.681

Note: n = 48, UR: Undergraduate Research

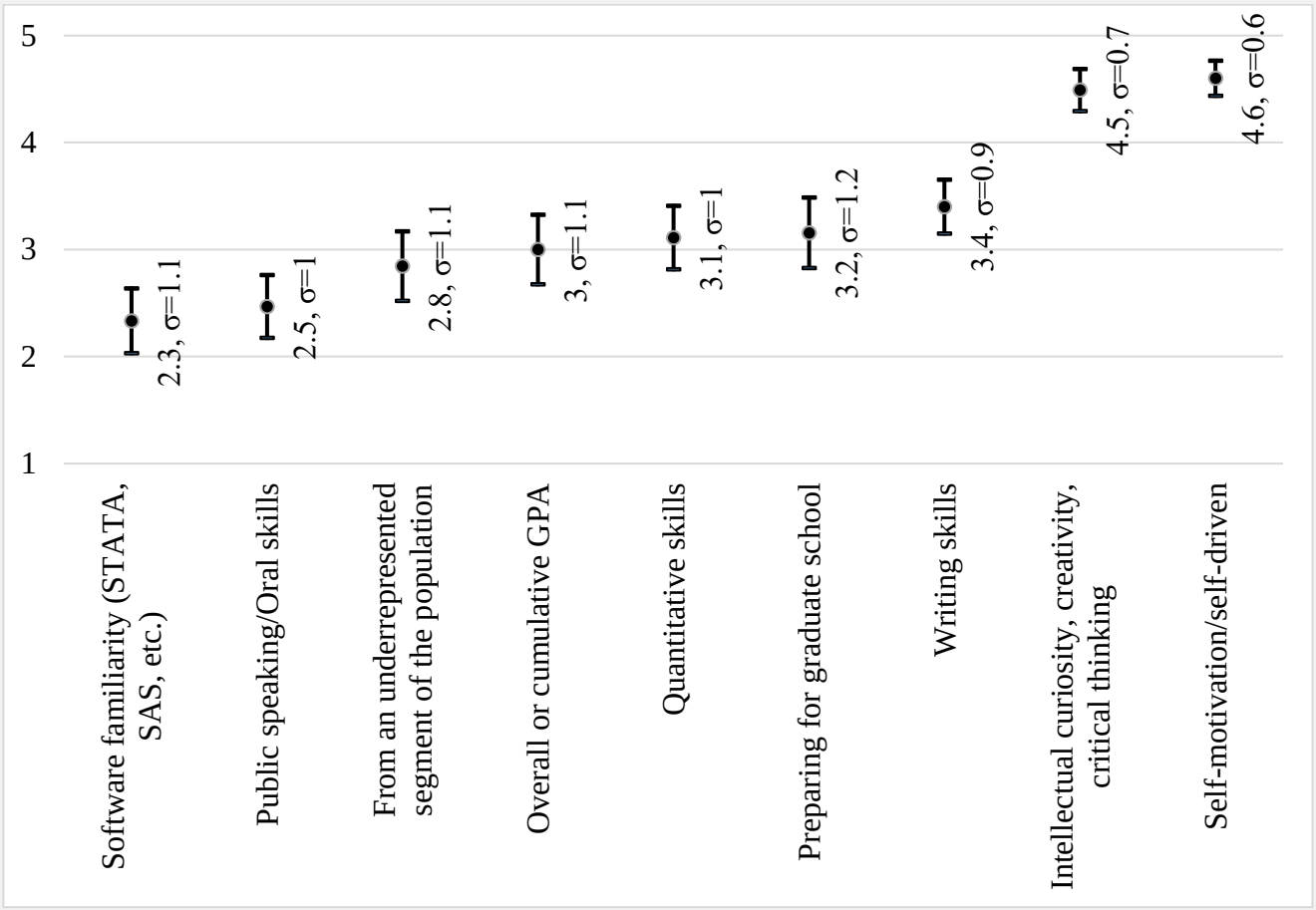

Figure 1: Average Importance Rating on Student Characteristics with 95% Confidence Intervals (1 = Not at All Important to 5 = Extremely Important)

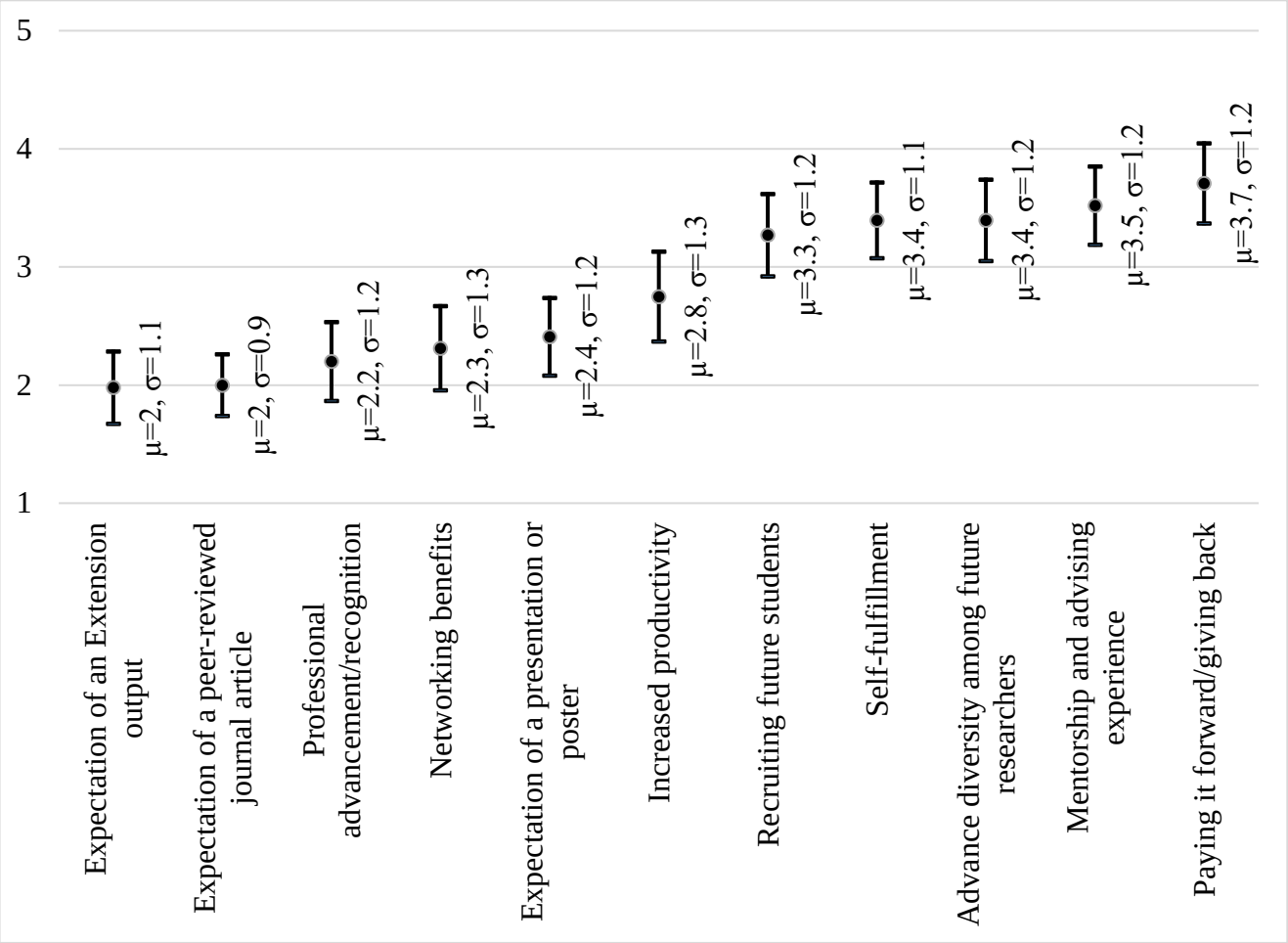

Figure 2: Average Importance Rating on Mentor Motivations with 95% Confidence Intervals (1 = Not at All Important to 5 = Extremely Important)

In terms of frequency of UR outcomes (1 = not at all, 5 = almost always), the most common are research presentations (3.2) and graduate school (3.1). Less common are formal writeups such as research articles (2.2), Extension articles (2.2), or news articles (2.1), all about equal frequency. Beyond formal output, faculty tend to agree (1 = strongly disagree, 5 = strongly agree) that students often gain intangible skills and soft skills such as thinking and working like a researcher, graduate school preparation, confidence/comfort doing research, analytical/communication skills, and career clarification (all between 4.2 and 4.4).

Surveyed faculty frequently worked with women (71 percent), first-generation students (46 percent), and minority students (40 percent). Surprisingly, very few (23 percent) of the undergraduates engaged in UR in the past three years went on to an economics graduate program. Most commonly, students went into industry (42 percent), though many were uncertain of their students' outcomes (20 percent). This indicates that perhaps one benefit of UR is that we are engaging a different subset of students than documented by previous studies and again points to another area of inquiry in this research area. These other areas could help shed more light on the rationales behind attracting women, first-generation students, and minority students along with their attitudes toward graduate degrees.

3.5 Factors Limiting Engaging in UR

Previous studies demonstrate several factors may limit faculty willingness to engage in UR (Morales, Grineski, and Collins 2017; Morales et al. 2021). On a Likert scale with 1 = never and 5 = always, no limitations were selected to limit engagement most or all of the time on average. Lack of student interest (2.8), time required (2.6), and lack of recognition in the tenure and promotion process (2.5) were the most limiting factors (Figure 3). Faculty interest (1.9) and appointment (1.3) were the least restrictive. Overall, these results indicate that none of the factors identified by previous studies change willingness to participate in UR; however, most of our respondents indicated a high degree of involvement in UR, unlike those who did not participate in the survey or who do not regularly engage in UR.

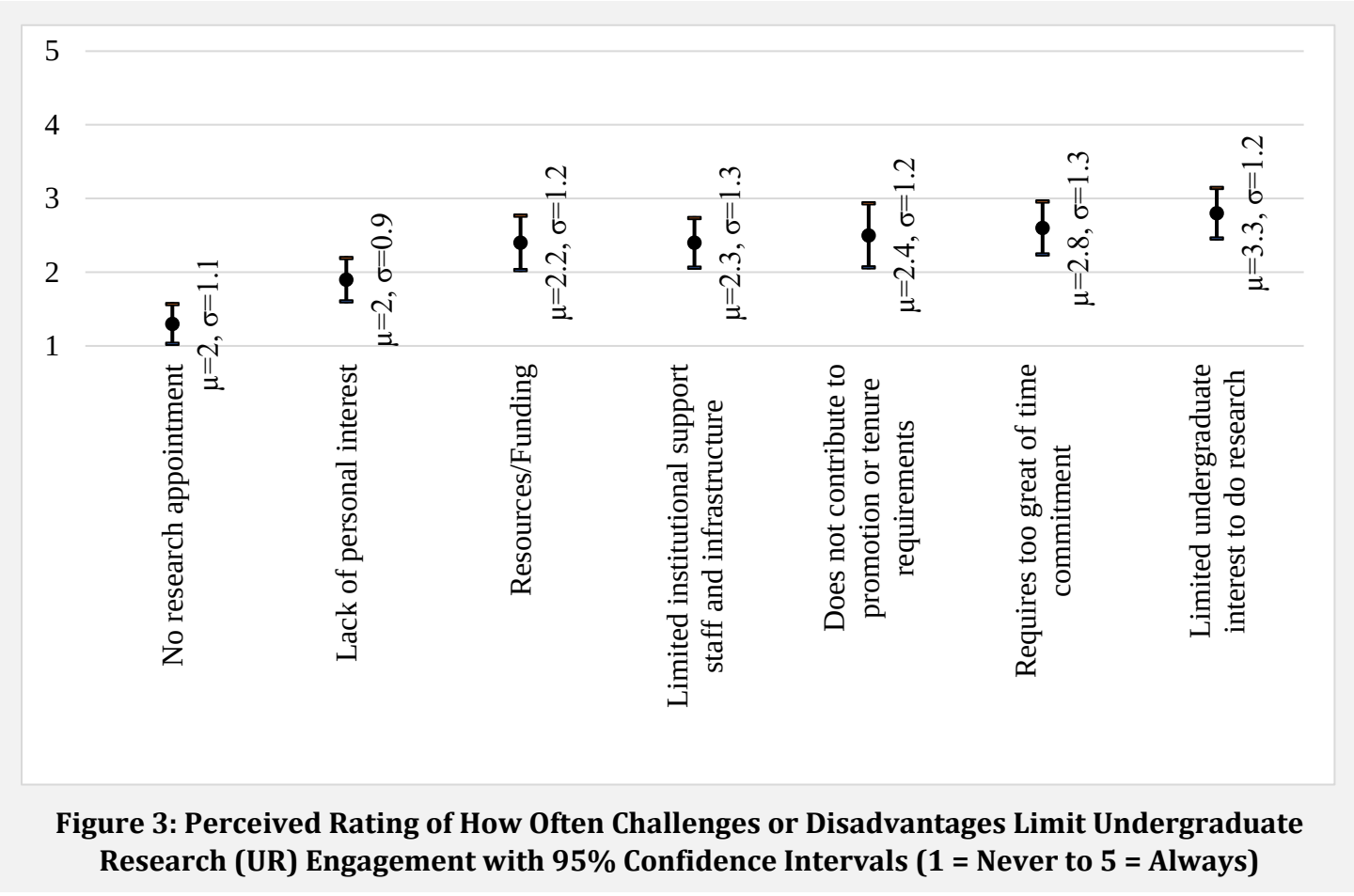

Figure 3: Perceived Rating of How Often Challenges or Disadvantages Limit Undergraduate Research (UR) Engagement with 95% Confidence Intervals (1 = Never to 5 = Always)

4 Discussion

The key messages from this survey sample are that faculty members in agricultural economics are more likely to engage in UR because of intrinsic motivations, but there is also a desire for more recognition and more resources dedicated to UR. Other disciplines have observed similar patterns of intrinsic motivation for participation and interest, including diversity (Morales et al. 2017; Hayward et al. 2017). Our enthusiastic sample is not hesitant to work with undergraduate students, though opportunities for increased engagement exist. Coupling both the many duties and responsibilities required of faculty members with the perceived low value of UR can put downward pressure on prioritizing UR engagement opportunities with students despite their intrinsic motivations. In summary, the limiting factors are limited funding resources, institutional support, and time as well as minimal undergraduate interest in research. Overall, these match similar themes from previous literature of predominant challenges to UR (Lunsford et al. 2013; Jones and Davis 2014), though differences exist. For example, Laursen et al. (2012)

show that limited resources are a relatively minor challenge to UR. Further, whereas limited time is often among the most important challenges (Adedokun et al. 2010; Thiry et al. 2012), limited student interest was equally important in agricultural economics. This may be field-specific since the vast majority of students are planning for a career in industry and may not see research as a complementary experience toward this end. If so, it may be useful to shift how research is marketed to students to convey the pertinence of skills gained.

4.1 Limitations

Several constraints may impact the generalizability and interpretation of our findings. First, the sample size and composition, though adequate for preliminary insights into a growing area of interest, do not encompass the full diversity of agricultural economists in the United States, which may limit the applicability of our results to all settings and contexts within the field. This is demonstrated by the preponderance of responding faculty who primarily work in agricultural marketing and policy, whereas the discipline has a large number of other sub-fields. We also recognize that the rapidly evolving landscape of agricultural economics and higher education may affect the relevance of our findings over time. Despite these limitations, this study contributes valuable preliminary insights and serves as a foundation for future research aimed at addressing gaps and extending our understanding of UR engagement in agricultural economics.

4.2 Recommendations and Future Research

Our field has an opportunity to increase engagement in UR in early career stages of faculty. Through institutional partnerships (such as the Economic Research Service cooperative agreements) and non-profit association trusts (such as the AAEA Trust, see: https://www.aaea.org/trust), students in agricultural and applied economics fields are receiving growing financial support. However, resources and support should also be directed toward advisors and foster the relationship between undergraduate mentees and faculty mentors. One starting point could simply be recognition of UR and including both the advisor's name and affiliation alongside the student. Organizational structures (such as departments, colleges, universities, and associations) can also play a significant role in abating these issues and provide pathways to obtaining the benefits of UR. For example, associations excel at fostering networking and development opportunities, and can do so for undergraduates (Agricultural and Applied Economics Association 2023). Levels of support can vary from more minimal approaches such as short courses on data collection platforms (such as Google forms or Qualtrics) or providing administrative assistance (such as gaining IRB approvals and editorial services), to more substantial interventions such as faculty time buyout or summer pay and/or paid summer research internships for students matched with faculty.

5 Conclusions

Overall, more research and a larger sample are needed to adequately generalize the thoughts of agricultural economists on engaging undergraduate students in research. In the interim, a broader discussion is needed at all levels to provide greater focus and guidance on the importance of mentor-guided research as an avenue of training and development of students. Moreover, an assessment of the perceived needs and benefits of undergraduates should be coupled with these discussions to ensure that there is a viable pool of students who want to engage in this practice going forward.

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Acknowledgments: This study was approved as exempt by the University of Florida Institutional Review Board (IRB Reference Number: IRB202200390). We appreciate the time taken by 50 of our colleagues to give their insights on undergraduate research. The authors declare no conflicts of interest. No specific financial support was used for the research conducted.

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DOI: https://doi.org/10.71162/aetr.626661