DEPARTMENT OF ECONOMICS WORKING PAPER SERIES

Creating Quality Undergraduate Research Programs in Economics: How, when, where (and why)

Stephen B DeLoach
Elon University

Elizabeth Perry-Sizemore
Randolph College

Mary O. Borg
University of North Florida

Working Paper wp2011-02

2075 Campus Box
Elon, NC 27244
Phone: (336) 278-5951
Fax: (336) 278-5952

Abstract

While undergraduate research (UR) has been growing across the academy for decades, economics has been relatively slow to adopt it as pedagogy. We argue for the development of comprehensive UR programs that not only require capstone research experiences, but integrate the development of foundational research skills throughout the curriculum. Fundamentally, there is a hierarchy whereby students learn basic research skills in lower-level courses, develop ability integrating content knowledge and research skills in upper-levels, and produce independent or collaborative research projects in later semesters. Successful UR programs depend on understanding this developmental model, integrating it into the curriculum, and taking advantage of resources to support it. To facilitate such improvements, we make six recommendations for departments to consider when building or strengthening their UR environment.

JEL Codes: A2
Keywords: undergraduate research, senior thesis, honors thesis, service learning, active learning

I. Introduction

Undergraduate research is a growing movement in higher education. It is embraced at all types of institutions and is increasingly prevalent across the humanities, social sciences, and sciences. While it has been virtually omnipresent in the sciences for decades, undergraduate research in economics is still in its infancy. A recent survey by McGoldrick (2008a) indicates that only a small fraction of economics departments consider doing undergraduate research to be an important goal for their undergraduate program. In fact, only 36 percent of programs surveyed reported the "ability to make an original contribution to the discipline" to be an important goal of their senior capstone or common experience.

While the case for undergraduate research has been articulated in other disciplines, economists have yet to recognize the value of investing time and energy doing undergraduate research in any kind of comprehensive way.[1] In this paper, we argue for the implementation of numerous types of undergraduate research that can benefit all economics students, not only those bound for graduate school.[2] Fundamentally, undergraduate research helps students learn how knowledge is constructed in a discipline by offering them firsthand experience with the process. In this sense, undergraduate research can be thought of as an over-arching pedagogical approach that individual faculty and entire departments can implement to better teach students the "economic way of thinking."

Even if one understands the potential value of undergraduate research in economics, it can be challenging to build a successful undergraduate research program. Casual empiricism suggests that many economists may be hesitant to get involved in undergraduate research because they do not know *when* to get students involved or *where* it is most appropriate to incorporate it into the curricula. For example, it is one thing to know that a research-based service-learning project is considered undergraduate research, but it is another to know when the

project is going to work best. Moreover, what kinds of skills can students learn in such an experience that can be built on in subsequent undergraduate research experiences? We argue that quality undergraduate research requires more than good mentoring by a single passionate faculty member. It requires a department committed to the kinds of curricular development that provide students with the opportunity to build the foundational skills in their earlier years.

The purpose of this paper is to provide a roadmap for faculty and departments to use in implementing meaningful undergraduate research experiences across the board. In the process, the paper makes several important contributions to economists' understanding of undergraduate research. First, we develop a taxonomy of the various ways in which undergraduate economics majors can engage in meaningful research that develops key critical thinking skills. These include: (1) course-based activities (e.g., shorter quantitative writing assignments, naturalistic observation, etc.); (2) course-based projects (e.g., semester-long service learning projects, term papers in econometrics, etc.); (3) capstone experiences (e.g., honors theses, senior seminar papers); and (4) collaborative research with faculty. Second, because the existence of multiple forms of undergraduate research is ultimately suggestive of a hierarchy based on knowledge, complexity and student independence, we create a developmental model of undergraduate research to guide the creation of new programs and improvement of existing ones. This includes the articulation of appropriate learning goals at each level of undergraduate research, including theoretical and methodological content, critical thinking, and research skills. The paper proceeds as follows: (1) in Section II we define exactly what we mean by the term "undergraduate research" and show how the steps of the research process can be directly linked to Hansen's (2006) list of proficiencies that all economics students should acquire as undergraduates; (2) in Section III, we develop our taxonomy of the basic type of research experiences and relate them

to well-defined learning goals and objectives. We also detail many of the key characteristics of each activity that faculty need to consider when making pedagogical decisions; (3) in Section IV we conclude with a discussion of six concrete recommendations for departments to consider when designing new programs or improving existing ones.

II. Why do Undergraduate Research?

The Council for Undergraduate Research (CUR) defines undergraduate research to be any "inquiry or investigation conducted by an undergraduate student that makes an original intellectual or creative contribution to the discipline." Kinkead (2003) writes that "another hallmark of undergraduate research is the role of the mentor faculty member who guides the novice researcher and initiates the student into the discipline" (6). In 2005, the National Conferences on Undergraduate Research (NCUR) and CUR (now merged) issued a joint statement that undergraduate research is a four-step learning process that involves:

> 1. the identification of and acquisition of a disciplinary or interdisciplinary methodology
> 2. the setting out of a concrete investigative problem
> 3. the carrying out of the actual project
> 4. finally, the dispersing/sharing of a new scholar's discoveries with his or her peers- a step traditionally missing in most undergraduate educational programs. (CUR and NCUR)

Essentially, undergraduate research involves the same steps as research done by professionals. A word of caution is warranted at this point: The above definition of undergraduate research is rather restrictive. It requires that students be engaged in all of these four steps of the process. Since the purpose of this paper is to argue for the holistic development of undergraduate research programs, we place more emphasis on the importance of providing students with experiences that develop fundamental research skills than on requiring that students complete all steps in the research process for each project. Ideally, however, students

will have the opportunity at some point to engage in a higher-level experience that meets this definition. Thus along with more traditional experiences like capstone or collaborative research, we discuss a number of course-based activities and projects that we argue fall under the more inclusive umbrella of undergraduate research experiences since they serve to develop the requisite skills that provide the foundation for deeper, more sophisticated undergraduate research later in their major.

The benefits of undergraduate research are as wide-ranging as the forms and levels of intensity that it can take. The undergraduate research module at the online *Starting Point: Teaching and Learning Economics* identifies these benefits and describes the results of studies of the student learning outcomes of undergraduate research experiences in a variety of disciplines. Undergraduate research helps students learn about both a particular topic in a field and the research process in general. It is inquiry-based learning that involves practicing a discipline and not just being told about it, and as such helps students learn both content and practical skills. As a form of engaged learning, it helps students understand the contexts for knowledge, can foster self-confidence and ownership of learning, and can enhance metacognition, or understanding of one's own learning. It promotes the cognitive development of students by developing expert learners, individuals who understand how a discipline is organized and can use that structure to ask and answer questions. And it promotes students' affective development as well, as it requires them to grapple with the unknown and make informed judgments about the answers to questions when there may be no one unambiguous answer. Some forms of undergraduate research also support faculty research and benefit colleges and their communities (Starting Point 2010).

In economics, a number of these benefits of undergraduate research are directly related to specific learning objectives that have long been advocated for the major. Economic educators Salemi and Siegfried (1999) support active learning for the undergraduate economics curriculum and stress the importance of using Hansen's proficiencies as the basis for defining learning objectives in and across courses in the major. A Hansen's proficiencies approach to the major is one structured to promote student skills in the following cognitive areas:

- Accessing existing knowledge
- Displaying command of existing knowledge
- Interpreting existing knowledge
- Interpreting and manipulating economic data
- Applying existing knowledge
- Asking pertinent and penetrating questions
- Creating new knowledge (List reproduced from Hansen 2006.)

Undergraduate research is a form of active learning that can develop a number of these proficiencies. In fact, by engaging students in *doing* economics, undergraduate research can help students better understand the value of what they learn in the major by showing the relationship of these proficiencies to one another. McGoldrick (2007) even shows that Hansen's proficiencies can be mapped directly to the research process (see Table 1).

Table 1: Undergraduate Research and Hansen's Proficiencies (McGoldrick 2007)

Key Steps in the Undergraduate Research Model	Hansen's Proficiencies for the Economics Major
1. Identifying economic issues	**Accessing existing knowledge:** Locate published research in economics and related fields; locate information on particular topics and issues in economics; search out economic data as well as information about the meaning of data and how they are derived.
2. Developing a research question	**Asking pertinent and penetrating questions.** Demonstrate an understanding of questions that stimulate productive discussion (factual, interpretative and evaluative) and that reflect particular concerns when engaged in discussing economic issues and policies.
3. Undertaking a literature search 4. Summarizing relevant literature	**Displaying command of existing knowledge:** Write a precis of a published journal article; summarize in a two-minute monologue or a 300-word written statement what is known about the current condition of the economy; summarize the principal ideas of an eminent economist; summarize a current controversy in the economics literature; state succinctly the dimensions of a current economic policy issue; explain key economic concepts and describe how they can be used.
4. Summarizing relevant literature 5. Identifying an area of potential contribution	**Interpreting existing knowledge:** Explain what economic concepts and principles are used in economic analyses published in articles from daily newspapers and weekly news magazines; read and interpret a theoretical analysis, which includes simple mathematical derivations, reported in an economics journal article.
6. Locating and analyzing data	**Interpreting and manipulating economic data:** Construct tables from already available data; explain how to understand and interpret numerical data found in published tables such as those in the *Economic Report of the President*; be able to identify patterns and trends in published data such as those contained in the Digest of Educational Statistics; read and interpret a quantitative analysis, including regression results, reported in an economics journal article.
7. Drawing conclusions 8. Comparing conclusions to identified literature 9. Applying analysis to current policy issue	**Applying existing knowledge:** Prepare a five-page written analysis of a current economic problem; prepare a two-page decision memorandum for a superior that recommends some action on an economic decision faced by the organization; write an op-ed essay on some local economic issue.
10. Presenting research to peers and/or faculty	**Creating new knowledge:** Identify and formulate a question or series of questions about some economic issue that will facilitate its investigation; prepare a five-page proposal for a research project; complete a research study with its results contained in a carefully edited 20-page paper.

In a survey of undergraduate majors, Hansen (2001) found that the average student rates herself between basic and proficient on the low- and mid-level proficiencies and very low on the highest proficiencies, suggesting that students are falling short of both understanding and experiencing the research process (234). Undergraduate research experiences may help students achieve these higher-level proficiencies and develop more practice and comfort with the lower-level ones. Towards that end, the following section of this paper suggests a wide variety of entry points and ways for students to experience undergraduate research in economics. Hansen's proficiencies can be used to identify and construct appropriate learning objectives that can inform the design and intensity of the undergraduate research experience.

III. Undergraduate Research Experiences

The common feature in any undergraduate research experience is that students must engage in the process of creating and disseminating knowledge. While far from universal within undergraduate economics programs, a 2005 survey finds writing experiences that stress aspects of research methods are considerably more common than they were just 15 years ago (McGoldrick 2008a). There are a number of different approaches currently used to teach these research skills. McGoldrick (2008a) finds that 60 percent of economics departments in the United States require some sort of capstone experience. Most of these are capstone courses (49 percent). Only 16 percent of departments require a senior thesis for all economics majors. But not all of these even emphasize making an "original contribution" as one of their learning goals, as only about a third of those departments with a capstone experience consider "making an original contribution" to be an important goal in their program.

While undergraduate theses and some capstone experiences easily satisfy this definition of undergraduate research, earlier opportunities that emphasize collaboration and original

contributions may also meet this criterion. More importantly, these earlier experiences are likely to improve the quality of subsequent experiences by developing the requisite skills and methodological knowledge. In general, undergraduate research experiences in economics can take one any one of four basic forms:

> **Course-based activities** like naturalistic observation, surveys, quantitative writing assignments, and experiments can often be structured to walk students through a subset of the steps of the research process.
>
> **Course-based projects** like term papers, service learning, and community-based and campus-based learning can be of a research nature.
>
> **Capstone experiences** like senior research projects and honors research experiences can allow students to develop and explore a research question of their own.
>
> **Student-faculty collaborative research** like summer research experiences can provide opportunities for students to work alongside a faculty member on his or her own ongoing research or on a project designed by both.

Recall that we have argued previously that for the purposes of curricular development, it is not productive to quibble over strict definitions of undergraduate research. By CUR's definition, only the latter two of these categories (capstone and collaborative experiences) could meet the strict definition of undergraduate research. In fact, even some capstone or collaborative research projects would not meet all 10 of the research steps outlined by McGoldrick (2007) (given in Table 1). In particular, step 2, developing a research question, and step 5, identifying the area of potential contribution, are often determined by the professor. This is almost certainly the case in collaborative projects, but may also be true of capstone seminar papers that are thematic in nature. Nevertheless, since all these activities and projects develop foundational research skills, we believe that it is important that a discussion of their role and form be included here.

These forms can be differentiated on the basis of five criteria. These include length of experience, intensity of activity, degree of student control over the research process (level of decision-making), pre-existing student content knowledge (i.e., level of course), and the extent of faculty collaboration and mentoring.[3] Of course, all of these dimensions are ultimately driven by the learning goals and objectives. These distinctions are summarized in Table 2 and discussed in detail below. A more complete listing of key references to specific research assignments that have been proposed for undergraduates in economics is provided in the Appendix.

III.A. Course-Based Activities

Course-based activities are perhaps the most controversial and least conventional of all of these forms. Because of the short length of time and the focus of the activities, many would simply categorize them as active learning, but not true undergraduate research. We, however, prefer to adopt the broadest, most inclusive point of view. As long as the objectives of the project provide the opportunity for students to make an intellectual contribution to disciplinary knowledge, such activities should be thought of as undergraduate research. If the potential exists to discover something new, the activity should be considered undergraduate research. This contrasts with activities where students are asked merely to replicate another's results. While good learning exercises that may in fact develop skills useful for later undergraduate research, they are not research themselves since the objective is limited to the students' discovery of pre-existing knowledge.

The key characteristic of course-based activities that distinguishes them from other forms is the scope and length of the activity. Student responsibility for all steps in the research process is not feasible in such activities. To deal with the time constraints, instructors have to take away many (if not most) of the key research decisions from the students. For example, the instructor

might determine the broad research question (steps 2 and 5 in Table 1) for the class rather than requiring students to find their own topics. In this kind of assignment, students are still free to create their own theories to answer the question and often make individual decisions pertaining to data and testing. While they may be following most of the steps of the research process detailed in Table 1, many of those (e.g., step 6: locating and analyzing data) may be done at a simplistic or superficial level depending on the level and goals of the course.

Arguably the most common and widely utilized examples of such an activity are so-called "economic naturalism" exercises first described by Frank (2002). Frank requires students to write a brief (750 words or less) economic argument to propose a theoretical explanation for some phenomenon that they observe in the world. For example, "Why do airlines charge much more for tickets purchased at the last minute, while Broadway theaters follow exactly the opposite practice?" (Frank 2002). While he does not specifically argue for the use of such exercises to teach students to do *research*, he does argue it teaches them how to *do* economics. Clearly such skills are foundational to doing more rigorous economic research later on.

A related set of exercises that specifically incorporates the use of data in creating and evaluating hypotheses is discussed in McGrath and Tiemann (1985). Specifically, they outline short writing assignments for introductory micro- and macroeconomics courses that force students to follow the steps of the scientific method. Unlike Frank's economic naturalism, McGrath and Tiemann provide a common question/problem to all students in the class along with raw data related to the problem. Because they tie their expectations to the steps of the scientific method, they are much more explicit about how their short papers relate to learning foundational research skills.

Table 2: Taxonomy of Undergraduate Research

	Course-Based Activities	Course-Based Projects	Capstone Experiences	Collaborative Research
Goals & Objectives	Application of course concepts & theories	Integration of course concepts & theories	Integration of curriculum, economic theory, literature & research methods	Integration of economic theory, literature & research methods
		Class presentations	Assessment of majors & curriculum	Introduction to advanced, graduate school-level methods & theory
			Local or regional undergraduate presentations	Professional presentations
				Journal publication
Pre-Requisite Knowledge & Skills	Skills related to content knowledge	Skills related to content knowledge	Integrated content knowledge	Integrated content knowledge
			Time management	Time management
			Adaptive persistence	Adaptive persistence
				Teamwork
				Attention to detail
Course Level	All	All	4th year	3rd or 4th years
Time Required	Days, Weeks	Weeks, Months	Semester, Semesters	Summer, Semesters

Table 2 continued

Project Intensity & Degree of Student Responsibility	Highly structured	Structured	Unstructured	Varied structure
	Students make few research decisions	Students responsible for limited number of research decisions	Students responsible for almost all research decisions	Students jointly responsible for research decisions
	Project covers few of steps in research process outlined in Table 1	Project covers more, but not all, of the steps in research process	Project covers most if not all steps of the research process	Project covers all steps of the research process, but students may not be solely responsible for all steps
	Question often common to all students in the class			High degree of oversight from faculty
Mentoring Focus	Individualized or Group	Individualized or Group	Individualized	Individualized
	More teaching than mentoring	Limited personal, professional development	More personal, professional development	Most personal and professional development
	Simple problem-solving-based mentoring	Complex problem-solving-based mentoring	High-level problem-solving, roadblocks, ill-structured problems	Socialization into the profession, including ethics and practice
			Maintaining focus and forward momentum	Emotional ups and downs of research
			Some emphasis on professional writing	Strong emphasis on professional writing

Another recent example similar to McGrath and Tiemann (1985) in its explicit use of rudimentary data analysis comes from Greenlaw and DeLoach's (2003) use of electronic discussions coupled with traditional writing. For example, in their "Productivity Slowdown" discussion, students are asked to explore competing theories about one of the most complex, controversial debates in macroeconomics over the past 30 years. Economists have developed dozens of theories to account for this, but no consensus has been reached. In this example, students discover the existing theories, but are asked to collect data and perform their own analysis to "test" the alternative hypotheses and present their arguments in the form of a 5 to 8 page paper. While their analysis is obviously less sophisticated than that of professional economists, the fact that they are doing independent analysis indicates this too is a rudimentary form of undergraduate research.

Finally, it is worth noting that many course-based experiments, especially in an experimental economics course, can be seen as part of course-based activities that meet the criteria of undergraduate research described here. Even when students are using a published experimental design, they are not simply replicating existing results since they are, by definition, generating new data.[4] As a result, it is a valuable research experience that gives students practice performing (at least) steps 6 and 7 of the research process. Of course, such experiments might also be part of a larger term paper. In that case, potentially all 10 of the steps could be touched upon (see the following section on course-based projects). Note, however, experiments run by the instructor to engage students in an active learning exercise merely to *illustrate* some basic economic concepts do not meet the strict definition of research. In those cases, the students are more "subjects" than they are researchers. Some may argue that it is not even necessary that the students perform the experiments. For example, Wells (1991) argues that since the outcome of

the experiment is ultimately unknown, students are engaged in the process of discovery. If so, then it too could be considered research even in the most traditional sense. The distinction is driven more by the goals of the instructor than the design of the experiment.

III.B. Course-Based Projects

The main difference between course-based activities and course-based projects lies in their length and purpose. Activities are shorter in length and the learning objectives tend to relate to a subset of content from the course. The level of student responsibility (i.e., number of steps of the research process under the control of the student) is also far more limited. Projects, however, are meant to be more summative. These require students to integrate most (if not all) of the content from the course into a cohesive research project.

The classic example of this is the econometrics research paper. Most schools incorporate such an assignment into their undergraduate econometrics course.[5] Students may be asked to formulate their own question, collect their own data from secondary sources and perform the appropriate econometric analysis to answer their research question. In this sense, all 10 steps (and all 7 of Hansen's proficiencies) are touched upon. However, due to time constraints the steps are obviously done with varying degrees of sophistication. As DeLoach (2010a) notes, such papers necessarily focus on the econometric content over the theory and literature. While many will require that some journal sources are used as part of a "literature review" for the paper, it is clear that the preponderance of the student's time (and grade) will focus on the extent to which he or she tests for, and addresses, the econometric issues that their data pose.

Obviously course-based research projects are not limited to econometrics courses. Research projects in applied field courses also fall into this category, as do some independent

research projects that students do at lower levels.[6,7] Like econometrics papers, these also tend to require that students formulate their own research question and topic. However, like the econometrics projects discussed above, these typically do not require students to fully experience all the steps of the research process like longer experiences can. Often, these papers are theoretical in nature, leaving econometric testing for another time (thus skipping steps 6-10 of the research process). For example, students might be required to do a full literature review, explain the theory, and propose a research methodology to test the theory.[8]

One of the more unique examples of course-based projects that may meet the definition of research is service-learning projects (Brooks and Schramm 2007). As with many other course-based projects, the instructor determines the focus for the project (steps 2 and 5 of the research process). Unlike typical course projects, however, students in service-learning projects are more likely to work in teams and their work is more likely to be applied research (versus basic research). One example of this kind of experience is so-called community-based research. Brooks and Schramm (2007) describe a project to examine the economic impact of the University of Vermont on its regional economy. This project involved a four-course sequence overseen by a 14 member advisory board that set the research agenda and ultimately was responsible for implementing recommendations based on the research. Two other examples come from Perry-Sizemore (2010a, 2010b). In each of these, she discusses the need to first familiarize students with the organizations and community they will be ultimately serving with their research. A final presentation to the relevant community (versus a merely academic audience) is made based on the research findings.

III. C. Capstone Experiences

Unlike course-based activities and projects, capstone experiences are more likely to be designed so that students are responsible for all the steps in the research process. This is confirmed by McGoldrick's (2008a) survey results. The vast majority of these experiences require students to develop a research question, complete a review of the literature, collect and analyze data, draw conclusions, and make a formal presentation. The goal of a capstone research experience is to integrate knowledge from most (if not all) of the student's economics courses. In this sense, these experiences appear the most recognizable to those of us who do "real research." Because of the increased length of time and depth of knowledge, they also are more likely to allow for the creation of new knowledge (step 5 in Table 1). However, as McGoldrick (2008a) found, in most departments the ability to make an original contribution to the field is not a primary goal for most of these projects.

Within the set of capstone and thesis experiences that do include making an original contribution as a learning goal, the length and structure vary widely. The shortest of these is the one-semester capstone experience (McGoldrick 2008b), while honors theses often last nearly two years (Siegfried 2001). Of course, there are a variety of experiences that fall somewhere between these in length. Borg (2010a) describes a project appropriate for a one-semester capstone research course. Lilly and Tiemann (2008) and DeLoach (2010b) describe a two-semester senior thesis process that begins with a 2-hour preparation course in the first semester and culminates with a 2-hour independent research project in the second semester. The big difference between one-semester experiences and longer ones lies in the depth of student experience and the type of mentoring possible (and expected).

For the most part, these experiences mimic the level of mentoring one expects (or hopes) to see in graduate school. In addition to the extended time, thesis students are usually expected to do significantly more literature review than their one-semester counterparts. Many are also expected to learn theories and apply methods well beyond what is covered in the standard curriculum. In this sense, students are not only expected to integrate and synthesize what they have learned in their major, but to develop the skills to learn independently. But unlike graduate students, undergraduates require considerably more hands-on mentoring. Siegfried (2001) suggests setting short-term deadlines to keep honors students on task (also see Borg 2010b). DeLoach (2010c) takes this a bit further, suggesting semester contracts over the course of a three-semester-long honors thesis.

III. D. Collaborative Research

Many colleges also offer students the ability to collaborate with faculty on a joint project. Often such projects start in the summer (see DeLoach 2011). The big difference here is that these experiences are more likely to follow an apprenticeship model. Most often, a professor invites students to work on a project that is part of the faculty member's research agenda. In a number of ways, these experiences offer students a taste of what graduate school is like. Faculty often think of this as a way to introduce gifted students to the profession. Because of this, the ultimate goals are quite different than other types of research undergraduates typically do. In fact, since it is collaborative and usually engages the student in the faculty member's own research, students are likely to have less independence in decision-making and possibly be individually responsible for fewer steps in the research process than they would in capstone experiences. For example, because these projects are often driven by the faculty member's

research agenda, the student may have no input into indentifying the research question (step 2 in Table 1). While students may experience less breadth, they probably do get considerably more depth in these collaborative experiences. The product of these projects typically is a new working paper that will be presented at professional conferences and (hopefully) published in a peer-reviewed journal.[9] However, this is not necessarily the case. Many professors choose to treat these projects more like deeper versions of capstone or course-based projects. These could range from community-based projects (e.g., economic impact studies) to student-driven research ideas. Institutional incentives can affect the design and intensity of these experiences since often these projects are part of the larger community outreach with which departments and colleges may be involved.

III.E. Summary

The various activities discussed above differ considerably and some would argue with our classification of some activities as "undergraduate research." Whether course-based activities should be considered research or not does not diminish their importance in the developmental process. These activities lay the foundation for later, successful, undergraduate research projects.

Fundamentally, there is a logical hierarchy whereby students learn basic research skills in lower-level courses, develop their ability to integrate content knowledge and research skills in upper-level courses, and ultimately pull it all together in either independent or collaborative research projects in their later semesters. The creation of successful undergraduate research programs depends critically on both understanding this developmental model and securing the necessary resources to support it. These issues are discussed in the following section.

IV. Implications for Programmatic Development

The developmental model of undergraduate research examined above has a number of implications for programmatic development. But there is no one-size-fits-all solution to these challenges. Much depends on the institutional culture and its constraints, as well as on each department's design of the economics major itself. For example, many economics departments have such a large service load, either to a business program or to general studies, that they have few degrees of freedom when it comes to developing new classes for the major. Rather than detailing what we believe to be the optimal program to support the development of a strong undergraduate research program in economics, we have chosen to discuss several possible options for departments to consider. Many of them require a departmental "buy in" in that course goals need to be reconsidered, and in some cases, curriculum changes are required. Others require institutional support. Even in the absence of either the optimal departmental curriculum or institutional support mechanisms, we believe these recommendations offer guidance to faculty in their efforts to begin building their undergraduate research program.

Recommendation 1: Integrate Hansen's Proficiencies in Lower-Level Courses

Whether or not the curriculum contains a stand-alone research methods course, it is critical that students have the opportunity to develop foundational skills early on. Many of the skills needed to do quality research can be more generally thought of as critical thinking skills. Most of these are already learning goals in most lower-level courses. However, one key area that is often over looked is the connection between theory and empirical evaluation. Even if students have not had a statistics or research methods course, students can still be asked to look to data to verify theoretical predictions, even if it is merely in a casual, descriptive way. Examples of such assignments include Greenlaw (2010) and Gregory (2010).

More generally, acknowledging the relationship between Hansen's proficiencies and the steps of the research process as described in Table 1, we can examine lower level courses to determine whether, where, and to what extent each of Hansen's proficiencies are addressed in the major. This can help us assess the degree to which we are providing the scaffolding necessary for a research-focused capstone that integrates these skills. As we have shown, lower-level undergraduate research experiences like course-based activities and projects should be considered in the set of pedagogical practices that can be used to address these proficiencies. One of the benefits to choosing these types of activities is that they may help students recognize the relationships of the skills they are building to one another, to the scientific method, and to the process of doing economics.

Recommendation 2: Create/Require a Research Methods Course

Perhaps one of the difficulties that economists face in helping our undergraduates do research is that standard research methods classes often put the cart before the horse. With some exceptions, most of these courses are taught as applied statistics courses with little time and attention given to the steps that come *before* the data analysis. If this is the case, students learn the technical steps to data analysis but not the more subtle steps of how to choose a research topic that interests them, how to put a research idea into a testable hypothesis, how to write a literature review that is more than an annotated bibliography, and how to find data for testing their hypothesis.

One reason for this is that many economics majors take a standard "business and economics statistics" course. Others may be required to take a general statistics course taught by

the math or statistics department. In either case, we need to understand that our economics majors need to learn "research methods" and not merely "statistics."

For example, a research methods course that students take *before* they take statistics or econometrics could spend two-thirds of the semester dealing with those questions that come before a student is ready to run a regression analysis. The last third of the course would cover simple hypothesis testing, with students learning to perform t-tests, crosstabs, ANOVAs, and basic regression analysis. The final assigned paper can ask the students to write a research proposal that includes a clearly stated hypothesis and a discussion of the method by which they would test their hypothesis. In this case, they still choose a topic, write a literature review that includes at least five articles from scholarly journals or books, specify a research thesis in the form of a testable hypothesis, discuss the data that exists for testing the hypothesis or write a survey questionnaire that could be used for collecting the data that they will need. Even if they are not actually completing the research, per se, students are still exposed to four of Hansen's proficiencies (1, 2, 3, and 5) without doing any actual data analysis. A research methods course that comes *after* could be designed in a similar way to the example above. But since students presumably have pre-existing knowledge of basic statistics (including regression), there is no reason they could not complete the research project. In this case, students will have completed their first undergraduate research project (a course-based project).

For various reasons, all departments have unique constraints that will affect their ability to offer such experiences to students. What is important is not when research methods are taught, but that they are taught. Whether as a stand-alone course or in conjunction with another course (e.g., a required econometrics course), the earlier students develop these skills, the better. If this course is taught, or these skills are learned, prior to the senior year, then (1) the capstone

experience can be more significant and (2) the most motivated students will have the opportunity to or do collaborative research with faculty either in the summer or during the year.

Recommendation 3: Consider Making a Research Experience a Required Part of the Senior Capstone

Recent research makes it clear that many economics departments should reconsider the goals of their senior capstone experiences. As McGoldrick (2008a) has found, few programs currently even consider the ability of undergraduates to make a contribution to the disciplinary knowledge to be a legitimate goal. This is at the heart of what it means to do undergraduate research. Moreover, forty percent of economics departments have no capstone requirement at all and only about one-third of those who do are emphasizing research in this way.

It is difficult to ascertain why so few of the existing capstone experiences do not require students to do research. Is it because they do not require statistics, econometrics or research methods? Or perhaps it is because the research methods course *is* the capstone? Or perhaps the capstone course is really simply one field course that all students are required to complete? Whatever the reason, whatever the unique constraints, we believe that all capstone experiences can and should incorporate undergraduate research as one of their learning goals. Given the relatively inclusive categories of undergraduate research summarized in Table 2, there is no reason why all undergraduate economics majors cannot have some sort of undergraduate research experience before they graduate.

Recommendation 4: Build a Research Team and Promote Peer Mentoring

In the natural sciences, the laboratory framework is often used to facilitate undergraduate research. While research questions, approaches, and needs are different in much of economics,

with some modification certain aspects of the laboratory model can be beneficial to output and learning in economics undergraduate research. In particular, laboratory teams centered around a faculty member's research agenda can simultaneously engage multiple students of different levels in works-in-progress at different stages of the research process. Research teams also provide opportunities for both faculty and peer mentoring.[10] As students gain more familiarity and experience with the faculty member's research, some can develop more independent but related projects, thus augmenting the body of work of the laboratory team as a whole and stimulating a cycle of research productivity for the lab.

One model from the sciences involves bringing students onto lab teams as first or second year students and allowing them to continue on the team for the duration of their undergraduate education. The students usually begin with basic lab tasks and gradually move on to more advanced tasks as their skills and knowledge increase. For instance, students may start by being introduced to laboratory equipment and learning and practicing a particular lab technique. They may later move on to applying that technique. Veteran lab members can assist in teaching lab techniques, which reinforces their own learning while bringing less experienced students along. Once a successful cadre of student researchers is established, the research team can become self-sustaining, with the most experienced students developing spin-off projects of their own. In one variation of this model (Russell et al. 2004), advanced students engage in a summer undergraduate research experience that is augmented with concurrent training on instructional techniques and collaboration with faculty on preparing courses with undergraduate research components for the following academic year. These students then serve as peer research mentors to the students in those courses.

Faculty members in the social sciences can set up a regular meeting time each week for students to meet with them to work on their research. This weekly meeting can be the economist's equivalent of laboratory time. Students can be divided into teams to work on various research studies or to work on different aspects of the same study. New members of the team can begin with data searches, data entry, and literature searches. As students advance in experience and knowledge, they can take on more sophisticated tasks such as literature reviews and basic data analysis. By the time students are juniors and seniors, they should be able to pose their own research questions and design their own studies.[11] At that point, they will be able to write their honors theses in economics or co-author papers with their faculty mentors. Bartkus (2007) provides an example of a research group in a college that business that includes faculty and corporate partners and allows students and alumnae who have published their research to serve as "research associates" in the program.

Economists can begin to establish these research teams by talking about their own research agendas in principles classes and undergraduate events in the department. The professor can ask students who are interested in learning more about economic research opportunities to visit during office hours. The objectives of the lab can influence how the faculty member selects students. For instance, for some projects, faculty may deem it necessary for interested students to take a special section of a research methods course as a dress rehearsal for membership on the research team. For other projects, instruction of these methods may occur within the lab itself. Of course, even the most motivated faculty and students may not be willing to do this work over a long period of time without getting some small amount of recognition for their efforts. These and other related issues are addressed in the recommendations below.

Recommendation 5: Seek Institutional Support

The costs of engaging in undergraduate research can vary depending on how and to what degree it is incorporated into an economics program as well as how well the existing departmental and institutional culture and organization make it possible. Faculty and departments that choose to invest valuable time in undergraduate research need support, which can come in the form of time, rewards, money and/or development. There are two sources for this support: internal and external. The latter source of support is discussed in the final recommendation.

The amount of institutional support that colleges and universities give to undergraduate research runs the gamut from none to substantial, depending on the institution's mission and resources. While some undergraduate research projects may be possible without assistance, the extent and sophistication of some vary with the level of financial support. The most important aspect of institutional support, however, requires no financial investment; for undergraduate research programs to flourish there needs to be institutional recognition of the faculty effort that goes into establishing a sustained undergraduate research program. Needless to say, these efforts should be recognized as teaching contributions during tenure and promotion reviews. Faculty development of class-based activities and projects that constitute undergraduate research should be recognized as investments in pedagogy. Collaborative research and some capstone experiences should be additionally recognized for the time and effort involved in mentoring students. And if a faculty member publishes a paper with a student, both should be acknowledged for the accomplishment.

Giving faculty who engage in higher-level undergraduate research projects released time from other teaching duties is a type of institutional support that is helpful but requires financial

resources. Many universities use a banking system for faculty who supervise independent study courses with students. For example, they establish a given number of independent studies that is equivalent to one course so once a faculty member reaches that number, he or she will receive a one course reduction in teaching load for the next term. An even better arrangement when resources allow, is to allow the faculty member to count his or her research team meeting as a course. The presence of binding budget constraints is another reason for departments to place increased emphasis on course-based activities and projects.

Public recognition for students and faculty who engage in research is another important form of institutional support. Many colleges and universities hold undergraduate research symposia that allow students to showcase their research accomplishments either through poster sessions or paper presentations. These can be defined as broadly or as narrowly as the university chooses. For example, a particular college or program may wish to hold its own symposium, or the symposium may be campus-wide and include creative projects as well as more traditionally defined research projects. Another form of public recognition comes by publishing a campus undergraduate research journal. To hold costs down, these journals can be published on the college or university's website.

Other forms of institutional support for undergraduate research require a larger financial commitment. For example many universities offer competitive grant programs that give financial support to both the faculty members and the students who engage in research together. Many colleges and universities provide summer research programs that pay students a stipend and offer them housing while they do research on campus over the summer. These programs are especially beneficial because both students and faculty can devote their entire attention to research during the summer months. Student travel grants that help pay for students to present

their research at professional meetings are another useful financial benefit that many universities offer their undergraduate researchers.

Clearly the level and types of internal support for undergraduate research vary widely across institutions. For faculty and departments seeking to strengthen the level of institutional support in the ways outlined here, assistance from external sources in the form of institutional benchmarking may be the most effective approach. This and other related issues are discussed in our final recommendation.

Recommendation 6: Seek External Assistance

The Council on Undergraduate Research offers many resources and opportunities for students and faculty engaged in undergraduate research. In addition to offering institutional memberships, individual faculty members and college administrators can join CUR. Between institutional and individual memberships, over 900 colleges and universities are represented in CUR. As its webpage states, as part of its mission CUR works to support funding for collaborative research, disseminates best practices through its publication *CUR Quarterly*, and offers workshops for individuals and institutions seeking to further their commitment to undergraduate research (Council for Undergraduate Research). In addition, it operates an online graduate school registry where undergraduate researchers can provide details of their research activities and accomplishments to graduate programs and a list of journals and symposia that showcase undergraduate student research. These materials can be useful resources for encouraging some of the types of institutional support described in the previous section.

NCUR and CUR recently merged. For years, NCUR's signature accomplishment has been to sponsor an annual conference for students. These conferences provide opportunities for students of all disciplines to network and to present original research to peers and faculty in

discipline-specific sessions. NCUR also offers faculty development sessions focused on best practices in mentoring and collaboration in undergraduate research. Beyond experiencing the learning benefits of delivering original research and receiving oral feedback on it, by taking advantage of the opportunity to attend sessions in many disciplines, students (and faculty!) begin to understand how the processes of intellectual inquiry compare across disciplines.

Specific to the economics profession, there are some first-rate examples of undergraduate research being showcased in national undergraduate journals such as the *Undergraduate Economic Review* published at Illinois Wesleyan University, the *Michigan Journal of Economics* at the University of Michigan-Ann Arbor, and *Issues in Political Economy* co-published by Elon University and the University of Mary Washington. In addition, some state and regional economics conferences hold sessions for undergraduate presenters.

Insofar as best practices are concerned, McGoldrick (2007) offers some specifically for economists. CUR publishes mostly non-discipline-specific literature (including Merkel's 2002 guide on how to mentor undergraduate researchers), and both CUR and NCUR offer opportunities for faculty engaged in undergraduate research to share pedagogical practices. The undergraduate research module at *Starting Point: Teaching and Learning Economics* is a new resource for economists who want more guidance on developing undergraduate research experiences. The module, one of 16 pedagogical modules on the site, provides resources and successful examples of undergraduate research in economics from campuses across the country.

An important source of external financial support for undergraduate research is provided through the National Science Foundation's Research Experience for Undergraduates (REU) Program. This grant program provides funding directly to universities that offer intensive summer research programs in a variety of academic disciplines. In addition to funding programs

in the natural and biological sciences, the program also supports summer research in the social, behavioral and economic sciences. A university with a strong undergraduate research program may apply to host a site by applying for an REU grant. A university that receives a grant to host a site will receive the funds necessary to operate the program as well as the funds necessary to support the students, including room, board and a stipend. More importantly, students from any college or university can apply to participate in one of the summer REU program sites.[12]

V. Conclusions

While undergraduate research is widely accepted and valued throughout the academy, economics departments have been relatively slow to integrate it into their departmental goals and curricula. This is true even at smaller colleges and universities that embrace undergraduate education as their primary mission. In this paper we have argued for the holistic development of comprehensive undergraduate research programs that not only require capstone research learning experiences, but that integrate the development of foundational research skills throughout the curriculum.

This paper lays the groundwork both for programmatic development as well as for future research. In particular, we have made a handful of strong recommendations to departments that are considering starting an undergraduate research program or wishing to improve an existing one. Far from being the final word on how to set up an undergraduate research program in economics, we hope this paper will begin a discussion about how to expand the role of undergraduate research in economic education. Because of the specific learning goals and objectives that are articulated for the various types of research experiences in our model, this paper also provides guidance for future researchers interested in assessing the effectiveness of various pedagogies.

VI. Appendix: Examples of Specific Research Assignments Proposed in the Literature

Type of Research	Examples	References
Course-based activities	naturalistic observation	Frank (2002)
	data collection from surveys	Jacobsen (1994)
	quantitative writing assignments	McGrath and Tiemann (1985) Greenlaw (2010) Gregory (2010)
	electronic discussions	Greenlaw and DeLoach (2003)
	experiments	Holt (2007)
Course-based projects	term papers	Alter (2010) DeLoach (2010a) Lam (2010)
	service learning	McGoldrick and Ziegert (2002) Brooks and Schramm (2007) Ziegert and McGoldrick (2008)
	community-based/ campus-based learning	Perry-Sizemore (2010a, 2010b).
Capstone experiences	senior research (thesis) projects	Lilly and Tiemann (2008) Borg (2010a) DeLoach (2010b)
	honors research (thesis) experiences	Siegfried (2001) Borg (2010b) DeLoach (2010c)
Student-faculty collaborative research	summer research experiences	DeLoach (2011)

VII. References

Alter, G. 2010. Family economy of 19th-century industrial workers. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/econ/studentresearch/examples/36329.html.

Bartkus, K. 2007. Fostering student/faculty collaborations through the "research group" model: An application to colleges and schools of business. *CUR Quarterly* 28:6-8.

Borg, M. 2010a. The effect of race and ethnicity on high school graduation rates in Florida. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/econ/studentresearch/examples/36498.html.

———. 2010b. Undergraduate research student contract. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/files/introgeo/studentresearch/examples/undergraduate_research_student.docx.

Borg, M., and E. Perry. 2007. Why, where and how undergraduate research matters to economics. Working paper, University of North Florida, Jacksonville, and Randolph College, Lynchburg, Virginia.

Brooks, N., and R. Schramm. 2007. Integrating economics research, education, and service. *Journal of Economic Education* 38:36-43.

Council on Undergraduate Research and the National Conference on Undergraduate Research. Joint statement of principles in support of undergraduate research, scholarship, and creative activities. http://www.ncur.org/ugresearch.htm (accessed June 22, 2011).

DeLoach, S.B. 2010a. Research paper in introductory econometrics. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/introgeo/studentresearch/examples/36319.html.

———. 2010b. Economics senior thesis. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/introgeo/studentresearch/examples/36324.html.

———. 2010c. Three-semester honors thesis. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/introgeo/studentresearch/examples/36302.html.

———.2011. A summer undergraduate research experience. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/introgeo/studentresearch/examples/54674.html.

Frank, R.H. 2002. The economic naturalist: Teaching introductory students how to speak economics. *American Economic Review* 92:459-62.

Greenlaw, S.A. 2010. Teaching principles students how to assess the state of the economy. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/econ/quantitative_writing/examples/31123.html.

Greenlaw, S.A., and S.B. DeLoach. 2003. Critical thinking and electronic discussion. *Journal of Economic Education* 34:36-52.

Gregory, C. 2010. Statistical graphs: AIDS cases and deaths by year and historical poverty in the U.S. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/econ/quantitative_writing/examples/24068.html

Hansen, W. L. 2001. Expected proficiencies for undergraduate economics majors. *Journal of Economic Education* 32:231-42.

———. 2006. Proficiency-based economics course examinations. Paper presented at the annual meeting of the Midwest Economics Association, Chicago, IL.

Holt, C.A. 2007. *Markets, games, and strategic behavior*. Boston: Addison Wesley.

Jacobsen, J. P. 1994. Incorporating data collection and written reports in microeconomics. *Journal of Economic Education* 25:31-43.

Kinkead, J. 2003. Learning through inquiry: An overview of undergraduate research. *New Directions for Teaching and Learning* 93:5-17.

Lam, D. 2010. Research on economics of population. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/econ/studentresearch/examples/36328.htm.

Lilly, G., and T. Tiemann.2008. On the struggle to attain universal competence in a complex skill: The case of a senior capstone experience. Working Papers 2008-06, Elon University Department of Economics, Elon http://ideas.repec.org/p/elo/wpaper/2008-06.html (accessed June 21, 2011).

McGoldrick, K. 2007. Undergraduate research in economics. *Handbook for Economics Lecturers.* http://www.economicsnetwork.ac.uk/handbook/ugresearch/.

———. 2008a. Writing requirements and economic research opportunities in the undergraduate curriculum: Results from a survey of departmental practices. *Journal of Economic Education* 39:287-96.

———. 2008b. Doing economics: Enhancing skills through a process-oriented senior research course. *Journal of Economic Education* 39:342-55.

McGoldrick, K., and A. Ziegert, eds. 2002. *Putting the invisible hand to work: concepts and models for service learning in economics.* Ann Arbor: U Michigan Press.

McGrath, E., and T.K. Tiemann. 1985. Introducing empirical exercises into principles of economics. *Journal of Economic Education* 16:121-27.

Merkel, C. A. 2002. *How to Mentor Undergraduate Researchers*. Washington, D.C.: Council on Undergraduate Research.

Perry-Sizemore, E. 2010a. The effects of condemned/restored homes on surrounding property values: A student/faculty collaborative research and service learning experience. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/econ/studentresearch/examples/36203.html.

———. 2010b. Using Census data to identify a town's housing needs: A student/faculty collaborative research and service learning experience. *Starting Point: Teaching and Learning Economics.* http://serc.carleton.edu/econ/studentresearch/examples/36204.html.

Russell, P.J., J.W. Rivenburg, C.F. Creedon, G. Anderson, and N.A. Yager. 2004. Peer mentors in faculty/student research projects and in the classroom. In *Reinvigorating the undergraduate experience: successful models supported by NSF's AIRE/RAIRE Program,* 11-12. Washington, D.C.: Council on Undergraduate Research.

Salemi, M., and J.J. Siegfried.1999. The state of economic education. *American Economic Review* 89:355-61.

Science Education Resource Center. *Starting Point: Teaching and Learning in Economics.* http://serc.carleton.edu/econ/about.html (accessed June 22, 2011).

Siegfried, J.J. 2001. Principles for a successful undergraduate economics honors program. *Journal of Economic Education* 32:169-77.

Wells, D.A. 1991. Laboratory experiments for undergraduate instruction in economics. *Journal of Economic Education* 22:293-300.

Ziegert, A., and K. McGoldrick. 2008. When service is good for economics: Linking the classroom and community through service learning. *International Review of Economics Education* 7:39-56.

VIII. Notes

[1] Borg and Perry (2007) have started to make a more comprehensive argument for the value of undergraduate research in economics. To date, however, most of the published papers in the economic education literature have focused exclusively on promoting different types of research activities. McGoldrick and Ziegert (2002), Brooks and Schramm (2007) and Ziegert and McGoldrick (2008) describe various service-learning projects with research components. More recently, McGoldrick (2008) describes a course-based senior seminar approach based on Greenlaw's (2006) seminal text.

[2] The paper builds on the work of Borg and Perry (2007) and our work on the undergraduate research module of the web portal *Starting Point: Teaching and Learning Economics* (Science Education Resource Center 2010). *Starting Point: Teaching and Learning Economics-A Source for Pedagogical Resources* is supported by a grant from the National Science Foundation (DUE0817382, $497,953, PIs: M. Maier, C. Manduca, K. McGoldrick, S. Simkins).

[3] The issues of student preparedness, structure (or project design) and faculty mentoring go hand in hand. Mentoring is best thought of as the necessary scaffolding provided by the faculty to meet the learning objectives. Since learning objectives differ significantly across undergraduate research experiences, so too does the kind and frequency of the mentoring. Some of these issues can be addressed through the structure of the experience. For example, rather than mentoring students in an introductory class about how to organize data in a spreadsheet, instructors can simply provide the ready-made data set for students use. In that way, faculty mentoring time can be used more efficiently by allowing it to focus on the primary learning objectives.

[4] There are literally thousands of published articles and books written about experiments and the use of experiments in classrooms. An excellent starting point for teaching students how to conduct experiments is Holt (2007).

[5] However, McGoldrick (2008a) reports that only about 40 percent of economics departments require econometrics and 10 percent require a research methods course.

[6] This represents an important opportunity since, according to McGoldrick (2008a), the typical undergraduate economics major will write about three term papers in his or her program (a little more at liberal arts institutions).

[7] For example, some departments will allow students to do research projects in their second or third years. These are not capstone experiences, then, and they may not be collaborative research with a faculty. Chances are, they are simply opportunities for students to get some experience doing research early on, even though they do not have all the requisite content knowledge to complete a larger, capstone-like experience. This could be a particularly good option for departments that do not typically incorporate research projects into their applied field courses or for those that may not offer econometrics frequently.

[8] Obviously applied econometric analysis is not required for all research. Certainly theoretical and historical research is done at the undergraduate level as well. However, due to the nature of

the modern-day undergraduate curriculum, most would agree that it is by far the most common type of research undertaken by undergraduates.

[9] Peer-reviewed publication need not be restricted to professional economics journals. There are an increasing number of undergraduate journals that publish economics papers (e.g., Issues in Political Economy, Undergraduate Economic review, etc.). For a listing of all undergraduate journals http://serc.carleton.edu/econ/studentresearch/further_UR_econ.html.

[10] The Winter 2010 issue of *CUR Quarterly* is devoted to models of peer mentoring in undergraduate research.

[11] This is especially true if the department has a research methods course that students take along the way. But even without such a course, students in such a setting can learn a great deal about research methods in the lab itself. This is the ultimate example of learning by doing.

[12] More information is available on the REU website: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=5517&org=NSF.