

Lessons Learned: The Evolution of an Undergraduate Research Program

Gregory Smith
smithg2@xavier.edu
Management Information Systems Department
Xavier University
Cincinnati, OH 45207, USA

Lauren Laker
lakerln@mail.uc.edu
Operations & Business Analytics Department
University of Cincinnati
Cincinnati, OH 45221, USA

Debbie Tesch
tesch@xavier.edu
Management Information Systems Department
Xavier University
Cincinnati, OH 45207, USA

Abstract

Undergraduate research programs are commonplace at many universities. However, little research has been conducted to evaluate their ongoing and long-term effectiveness from the standpoint of the undergraduate student researcher. In an effort to gain perspective from the student researcher, including their thoughts on such a program, a survey was conducted of past participants of a business school research program which brings together three stakeholders in the research process: a faculty member, a business executive mentor, and the undergraduate student researcher. The results presented highlight the major benefits and deficiencies of the existing program from the student's perspective and provide an evaluation of the program's overall effectiveness. In addition, our findings are compared to the results of a similar survey, performed fifteen years earlier, of the same undergraduate research program. The comparison reveals a maturation of a program which has evolved to better support the financial needs and time demands of today's students.

Keywords: undergraduate research, student engagement, academic theory, mentor

1. INTRODUCTION

The cost and relative importance of attaining an undergraduate degree in today's economy

continue to rise. Students and institutions have recognized that a quality education is essential to meet market demands. A growing movement to improve the undergraduate educational

experience is the offering of undergraduate research opportunities. (Boyer Commission on Education Undergraduates in the Research University, 1998 & AAC&U 2002 Report) Such valuable opportunities provide students with deepened learning experiences enabling them to further develop skills desired by both employers and graduate schools.

The literature has shown that undergraduate research increases student engagement (NSSE 2010), fosters the development of new skills (Lopatto, 2003 & Lopatto, 2006), enhances academic or professional credentials (Lopatto, 2003), and helps develop collegial working relationships with faculty research mentors (Lopatto, 2003 & Seymour, Hunter & Laursen, 2004).

Student engagement in learning is a key element to improving the quality of education attained. Engaged students move beyond passive receivers of information to critical thinkers capable of analyzing complex issues and generating new knowledge. In addition, students gain or refine the following skills: improved presentation, writing, research, communication, and relational (Tan 2007, Lopatto 2003, & Seymour, Hunter & Laursen, 2004). The 2010 results from the National Survey of Student Engagement support this as they find undergraduate research is a high-impact engagement practice among students. (NSSE 2010)

Skills acquired through a research experience ultimately enhance a student's academic or professional credentials, regardless of the path a student plans to follow after graduation. For graduates looking to enter the workforce, employers may substitute a rigorous research experience for years of practical experience (Hoffman, 2009). For students interested in pursuing a graduate degree, a successful undergraduate research experience demonstrates the essential skills graduate admissions committees look for in prospective candidates.

The personal experiences can be fruitful and lasting as well. Students often cite the development of collegial working relationships with faculty mentors as a benefit of undergraduate research (Seymour, Hunter & Laursen, 2004). They value the shift from a distinct professor and student relationship to one of partners working toward a common goal. A

primary benefit of this relationship is acquiring guidance and knowledge of an expert in their field of interest. In addition, this transition also facilitates an environment where students often feel comfortable reaching out to their mentors for personal and career guidance. This relationship frequently continues long after graduation (Seymour, Hunter & Laursen, 2004).

In this paper, we present a business college's funded undergraduate research program and the findings from a survey of its student researchers who participated and completed the program within the last ten years. The results highlight the strengths and weaknesses of the program and provide a window into the program's overall effectiveness. In addition, our findings are compared to the results of a similar survey of the same undergraduate research program from 1996. Our findings ultimately suggest that the program has matured over time. We provide recommendations for this and other undergraduate research programs to support their growth and maturation.

2. THE UNDERGRADUATE RESEARCH PROGRAM

The motivation for the undergraduate research program at Xavier University was derived from an existing program at the University of Alabama (O'Clock & Rooney, 1996). The idea was to pair undergraduate student researchers with faculty and business executives on a manageable research project with the intention of creating a written piece which could be presented at an academic conference and/or submitted to a peer-reviewed academic journal. The student's role was to be many fold. This could include work in the area of literature review, survey generation, statistical methodology and application, technical writing, and presentation.

While teacher scholar research models have many existing applications, the teacher, mentor, and scholar model was a novel idea.

The Downing Program (Prior to 2002)

The Jack and Mary C. Downing Teacher/Scholar/Mentor Program at Xavier University in Cincinnati, OH, was established in 1987 in its Williams College of Business (COB) with the goal of providing talented business students an opportunity to engage directly in

research projects with faculty members, in their specific disciplines, and business executives from the local business community.

Originally, the length of the Downing Program for each project was two consecutive semesters. The program was available to full-time business students who had completed their sophomore year of study, declared their major in business, and at least one year of course work remaining. A selection committee of business school faculty maintained responsibility for student selection to the program. This committee was comprised of representatives from all departments in the COB as to not bias the selection by department. Selection took place in the fall semester and awarded students began their research projects the following spring semester. In addition to common student academic transcripts, students applicants were required to provide a list of their extracurricular activities, past and current employment, three letters of reference, and a two-page essay outlining their academic and professional interests. If selected as a Downing Scholar, a student would receive a tuition reduction scholarship of \$1,500 per semester of participation. In exchange, the student was expected to work 12 hours per week with their assigned faculty mentor. A student would also be assigned to an executive mentor in the business community by the COB and would be required to meet them, on an informal basis, several times over the course of their project. (O'Clock & Rooney, 1996)

Faculty mentors for this program were chosen by the same selection committee of business school faculty. Their selection was based on specific research proposals, agendas, and project budgets. Full time, tenured or tenured track faculty members of the business school were eligible to apply. Faculty selected for the Downing Program were awarded a small stipend per semester for use toward scholarly activities associated with the research project. The faculty member was then matched, by the selection committee, to a selected student researcher. Students and faculty were matched by the committee based on stated academic and research interests and were not required to be studying and teaching in the same department (O'Clock & Rooney, 1996).

Ultimately, the faculty member was expected to help the Downing Scholar develop an understanding of the research process and its role in the academic environment, promote new

research, and aid students in improving critical thinking skills, ability to analyze data, and understanding how knowledge is constructed.

A final summary of the project and findings, budget and any generated papers were to be submitted to the selection committee at the conclusion of the year long project.

The Downing Program Today

The Downing Scholarship Program has evolved to meet the changing needs of the students, faculty, and business environment. While the purpose and many of the details of the program are the same as previously described, three substantive changes to the Downing Program occurred in the year 2002.

The first was to student and executive pairings. At the inception of the program, a Downing Scholar was assigned to a specific executive from the local business community for the duration of the project. Since that time, in an effort to initiate professional networking and career connections for all business students, the COB implemented a college-wide executive mentoring program. Therefore, the general executive mentor assigned within the COB replaced a Downing specific mentor. As such, executive mentors are no longer specifically assigned to projects. This change shifted the regular interactions with the business mentor to occasional interactions with no specific research goals or shared interests required. This, in effect, has reduced the program to a general teacher scholar research model. See Gardner et al. 2010 for a thorough discussion on the teacher scholar model.

The second change involved project duration. Originally, the Downing Program consisted of two semesters of research. It was found that this period of time was insufficient to adequately meet the requirements of most projects. Downing Scholars now have three semesters to complete their research projects.

The third and final change made to the program was to student funding. Compensation for students increased from \$1,500 per semester to \$2,000 per semester. Coupled with the increase in project duration, the total award increased from \$3,000 to \$6,000. Students were also given the option of receiving a portion of the award as taxable income, rather than assign the entire award to scholarship.

3. PARTICIPANT RESPONSES

As part of a larger project to assist the Downing Program selection committee in their selection process, a survey was conducted in fall 2010 of participants in the Downing Program who completed projects since the program's 2002 enhancement. This effort was the first external evaluation of the program since 1994 and only the second in its 23 years of existence. The intention of the survey was to gain insight into the effectiveness of the program, areas in need of improvement, and outcomes resulting from the projects.

The first part of the survey asked respondents to indicate their level of agreement with statements about the program based on a seven point Likert scale ranging from strongly disagree to strongly agree. The items available to respondents were repeated from the 1994 survey as to provide insight into the state of the Downing program and its maturation. Mean responses from the 1994 survey (n=15) are compared to mean responses to the 2010 survey (n=15) in Figure 1. Only historic average data was available from the 1994 survey.

In addition, the student researchers were asked about the resulting research deliverables and their outlets for publication. The results are found in Figure 2.

Also, in an effort to better understand respondent sentiment, several open-ended questions were included in the 2010 survey. They were as follows:

- Please briefly describe the most significant/most memorable aspect of your Downing experience.
- What were your incentives for becoming involved in the Downing program?
- What do you perceive to be the benefits of your participation in the Downing program?
- What do you perceive to be the weaknesses or shortcomings of the program?

4. EVALUATION OF THE PROGRAM

A telling sign of a vibrant undergraduate research program is the willingness of prior

participants to repeat the experience (Alexander B., Foertsch J., Daffinrud S., Tapiar R., 1997). This establishes a positive perception of the program for future potential participants. For this study, nearly all students surveyed in 2010 strongly agreed that they would repeat the experience. In comparison to the 1994 survey, there was a slight improvement ($\mu_{1994} = 6.7$ vs. $\mu_{2010} = 6.8$) in the 2010 results for the mean level of agreement.

When openly queried about the benefits of the program, past participants indicated two aspects which stood out as consistent drivers of this positive perception of the program: acquisition of new knowledge and mentoring relationships. These support the findings of Lopatto (2003).

Interestingly, a majority of respondents listed gaining new knowledge as an incentive for application. The responses varied from "an interest in gaining research experience" to "learning skills not taught in the classroom". Thus, the incentive was proven valid as acquisition of new knowledge was a primary factor contributing to an overall positive perception of the program. Some of the supporting responses were specific to learning about the research process, while others were more general in nature, such as "exposure to new ideas" or "learning outside the classroom."

The development of relationships with mentors is a well established benefit of undergraduate research. This aspect did not initially appear as transparent to the students as an incentive to participate as only three of the respondents stated it was a relevant factor. Yet, more students stated faculty mentoring was the most significant memory/memorable aspect of their Downing experience than any other response. As one student stated "The most memorable part was working closely with a faculty member, specifically in my major." This is supported in the 2010 survey where respondents were asked whether the level of interaction with their professor met their expectations. The majority of respondents either moderately agreed or strongly agreed. In comparison to the results from the last survey, there was a decrease in mean degree of agreement in response to whether the level of interaction met their expectations. ($\mu_{1994} = 6.1$ vs. $\mu_{2010} = 5.8$) This decrease may be the result of the loss of interaction with an executive mentor which required an increased level of interaction with faculty. Given the level of agreement, these

results support the idea that interaction with their professors is a key element in their positive experiences with the program.

In general, the previous were non-monetary benefits of the program. So, to validate the comprehensive view of such benefits, respondents were asked to gauge the overall sufficiency of these benefits. The results of the survey show that the non-monetary benefits have impacted the students. Mean agreement of the benefits of the non-monetary rewards of the program remain unchanged from 1994 to 2010 (6.2)

Financial reward, in light of the cost of education today, is also a clear driver for the success of this program. Due to the increased amount and change in form of payment to the students, the increase in mean degree of agreement ($\mu_{1994} = 6.1$ vs. $\mu_{2010} = 6.5$) validates the changes made in 2002. When asked to describe their incentives for becoming involved in the program, the majority of respondents listed monetary rewards as a primary reason for participation. Thus, providing adequate financial reward is important for students who are considering applying for this program. However, after the experience, few mention financial reward as a benefit of the program.

Another benefit of the program changes made in 2002 is the increased program length. In 1994, participant sentiment was extremely low ($\mu_{1994} = 2.7$) as it pertained to the length of the program. However, with the 50% increase in duration, the respondents' mean nearly doubled ($\mu_{2010} = 5.3$). Again, this provides a solid incentive for future participants in the program.

Last, as it pertains to the research process, theory, and practice, the results are somewhat troubling. When queried about a heightened awareness of the research practice, participants in the 2010 survey revealed a reduction in the mean response ($\mu_{1994} = 6.2$ vs. $\mu_{2010} = 6.0$). as compared to the 1994. A similar reduction was experienced when respondents were queried about their project's merging of theory and practice ($\mu_{1994} = 6.0$ vs. $\mu_{2010} = 5.3$). However, students were creating publishable and presentable work. There was a large increase in the number of academic conference presentations, but the number of actual publications was halved.

Interestingly, past participants made no mention of the executive mentor in any of their comments on the 2010 survey. Therefore, we must conclude that the executive mentor contribution is no longer significant to the project but rather to the student as a career mentor.

5. RECOMMENDATIONS TO THE CURRENT PROGRAM

Overall, it appears that several aspects of the program have led to a positive perception of the program from past participants. A financial incentive helps attract students to the program along with potential mentoring relationships and acquisition of new knowledge, the latter two are components participants indicated made the experience memorable and worth repeating. However, there are some shortcomings in the program. Based on the results of the survey, the primary weaknesses and shortcomings noted about the program relate to the student work structure. As stated by one respondent "... enjoyed the freedom given in this program to set your own standards and goals... But, I would have liked to have had specific requirements or guidelines that I was working toward." Improving the work structure in the following three areas should help to improve the overall effectiveness of the program: an introduction to research methods seminar, establishing a forum for showcasing work in-process and completed work, and more consistent interaction with the faculty partner.

The first recommendation for the program is to create a multiple session seminar to introduce students to research methods. Current faculty in the COB could present their ongoing and complete research and discuss the methods they employed with the student scholars. Since a substantive portion of the student research involves literature review, university librarians could also participate and introduce strategies and techniques for using university resources. Such a program could help students gain perspective on the rigors of academic research and see the integration of theory and practice.

The second recommendation for the program is to increase the recognition of work completed at informal public presentations in the COB at the completion of each semester. The presentations would offer an opportunity to showcase student and faculty contributions to other current scholars and members of the academic

community at large. The scheduled events would help motivate students to complete team research goals and give them the opportunity to field outside comments and suggestions. In fact, Kinkead (2003) found that "For many students and faculty, the act of research and its resulting product is reward enough; however, public recognition is important".

The final recommendation concerns the interaction of faculty and student researchers. The 2010 survey included a simple question that asked past participants the amount of time they spent working with their assigned faculty member. In response to this, 80% indicated that they spent 0-2 hours a week and 20% stated they spent 3-5 hours. This falls far below the recommended 12 hours of interaction. We suggest that students and their professors be expected to meet at a designated time and place regularly, much like other classes in a student's schedule, with required tangible outputs to be presented at the end of each semester. This could also provide the professor mentors greater opportunity for improved communication of the research process as a whole and continue the lessons of the research seminars. The output requirements and consistent meetings would help improve two aspects of the program where the survey revealed a decrease in mean agreement since the last survey: appropriate level of interaction with the professor and awareness of the research process.

We would also suggest that the program examine the role of the executive mentor. It is clear that the executive mentor no longer plays an active role in the program. As such, the mission of the program is not completely being met. The selection committee should address the ongoing need for an executive mentor.

6. RECOMMENDATIONS TO OTHER PROGRAMS

We would also like to make several recommendations to current and proposed undergraduate research programs at other universities. They are drawn from the current positive and proposed changes to the current COB program. The recommendations are as follows:

- Work diligently to match students to faculty with similar research interests

- Provide at least 3 academic semesters for the program
- Provide adequate financial incentives to candidates that can be drawn in part as scholarship and in part as taxable income
- Encourage faculty and student mentoring through engagement events
- Create a short seminar series to introduce students to general research methodologies
- Create a series of research presentations each semester to showcase the undergraduate research being performed
- Establish regularly scheduled meetings with faculty and student researchers to keep students engaged in the research and on track
- Strongly encourage that all works either be presented at conferences or submitted for publication (rewards should be considered for those papers accepted for either).

7. CONCLUSION

Today's students are constantly looking for ways to stand out from the crowd as they migrate towards employment or graduate school. One area that continues to grow and provides such an opportunity is undergraduate research. In this paper, we describe and benchmark the evolution of a business college's undergraduate research program from its original form to its current form. Past participants of the current research program were surveyed and their results were compared to those from participants in the old program drawn from a similar study performed 16 years earlier. Through comparison, we found the program to be evolving and vibrant. However, it was not without its failings. While financial incentives and rewarding mentoring experiences were shown to be strengths, students did not feel as strongly about their gained research skills and the overall work structure of the program. Based on our findings, we were able to make recommendations to the current program to better equip it to thrive and positively evolve. These recommendations along with the positive aspects of the current program provide solid advice for existing or proposed programs.

8. REFERENCES

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Appendices

Figure 1: The State of the Downing Program

Question	1994 μ response	2010 μ response	% Change
My involvement in the Downing program provided me with sufficient monetary/economic rewards.	6.1	6.5	6.56%
My involvement in the Downing program provided me with sufficient non-monetary rewards.	6.2	6.2	0.00%
My involvement with the Downing program made me more aware of the research process and its role in the academic environment.	6.2	6	-3.23%
The project we worked on involved a merging of academic theory and practice.	6	5.3	-11.67%
The level of interaction with the professor met my expectations.	6.1	5.8	-4.92%
The program's time frame was sufficient.	2.7	5.3	96.30%
In hindsight, if given the opportunity, I would certainly participate in the Downing program again.	6.7	6.8	1.49%

Figure 2: Research Deliverables

Question	1994 Yes responses	2010 Yes responses
Did the research lead to a publication of an academic paper/article?	4	2
Was the research presented at an academic conference? (published as proceedings)	2	7