

# Enhancing undergraduate research opportunities in the biological sciences at UW–Eau Claire using student perceptions of course–related and independent research experiences



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## Why research?

Undergraduate research, or the original work of undergraduate students and their collaborating faculty mentors, has long been viewed as a meaningful component of the undergraduate experience.<sup>1</sup> Previous studies have highlighted that:

- Milwaukee College of Engineering study reported that 70% of students who participated in research entered graduate school.<sup>3</sup>
- Research stimulates interest in subject material, enhance ability to adapt to new situations, and builds critical thinking<sup>2</sup>

While these previous studies provide a good background and base of knowledge about the benefits of undergraduate research experiences, we wanted to generate knowledge about the benefits to students involved in undergraduate research experiences at UW–Eau Claire, and more specifically, students involved in the biology and biology/molecular biology (B/MB) programs.

- 1 in 10 University Wisconsin–Eau Claire students are involved in collaborative research
- Over 500 students present posters at Student Research Day annually
- In 2009, nearly 10% of student presenters at Student Research Day were from biology or B/MB

The aim of this project was to generate knowledge concerning undergraduate research experiences in the biology and B/MB programs at the University Wisconsin–Eau Claire to help inform an effort aimed at enhancing the undergraduate research experience in these fields. Increasing the number of students involved in research in biology and B/MB would then have the potential benefits of recruiting stronger students, in retaining a broader range of students and talents, and would increase the success of our graduates in the pursuit of their professional goals.

Our goals were to:

1. Identify the student interest in and perceived value of undergraduate research experiences
2. Identify the student perceived challenges to participating in independent research in the biology and B/MB programs
3. Determine if the correlation between students participating in research experiences and entering post–graduate programs exists on our campus
4. Use the data collected to compare course–based and independent research experiences, and to enhance the current research models in the biology and B/MB programs

## Methods

### Literature review

- Analyzed over 35 primary literature sources regarding undergraduate research
- Provided foundation for analysis of undergraduate research trends, importance of research in student preparation, and a resource of undergraduate research models
- Background for development of student survey questions

### Graduate Survey

- 16 question web survey disseminated to spring and winter 2009 graduates from the biology and B/MB programs
- Questions regarded experiences in their programs, research experiences, skills acquired in their programs, and plans following matriculation
- 67 completed surveys representing ~2/3 of all 2009 graduates
- Calculated frequencies and used chi–square analysis to determine significance

### Research experiences and expectations survey

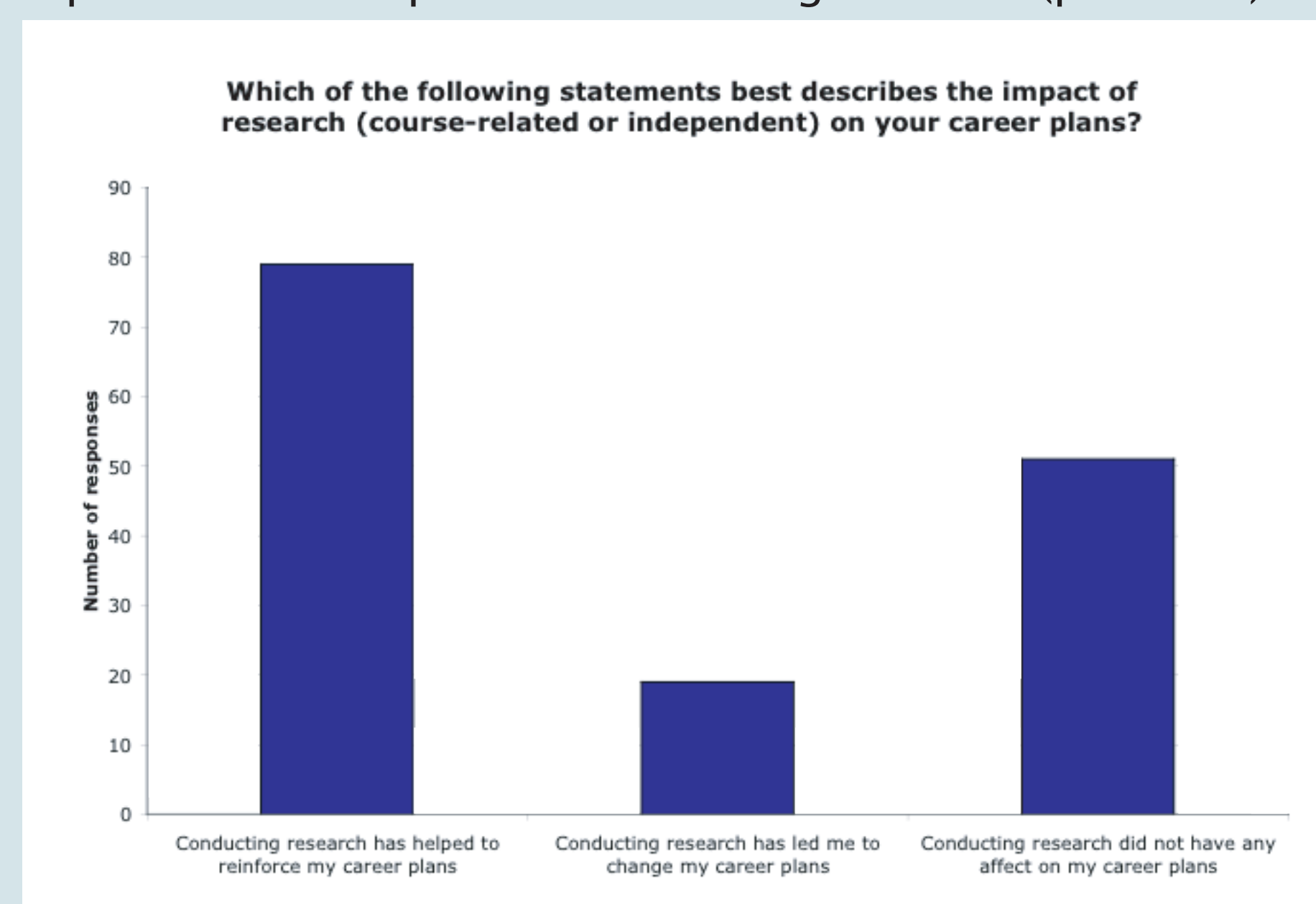
- 25 question Qualtrics survey of current biology and B/MB students
- Questions regarded experiences in course–based and independent undergraduate research
- Survey yielded 196 responses, equivalent to 27% of students in the biological sciences
- Calculated frequencies and used chi–square analysis to determine significance

## Results

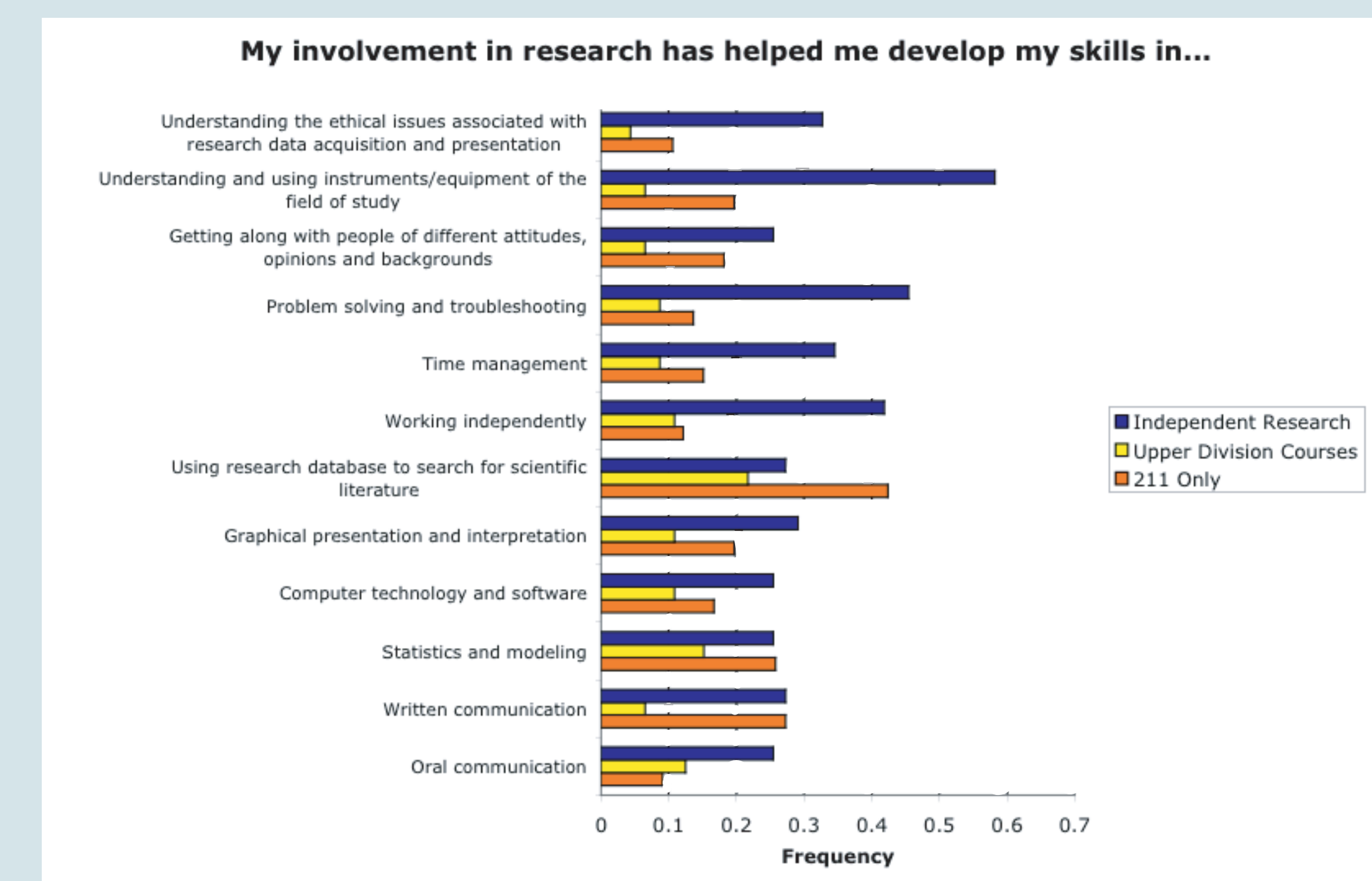
According to our survey results, within the biology and B/MB programs, there is a great demand for undergraduate research experiences. Out of the 196 completed "Research experiences and expectations" surveys, 140 students had not participated in independent undergraduate research. Of these 140 students, 75% percent responded that they wished to be involved in independent research before graduation.

### Student perceptions of the value of research experiences:

- Students who participated in undergraduate research (course–based research and/or independent research) reported that these experiences were more valuable or valuable compared to their other classroom training to their overall education, as compared to the experience not being valuable ( $p < 0.001$ ).



**Figure 1.** The effects of research experiences on student career plans. A significant number of students responded that their experiences in independent research or course–based research reinforced their career plans ( $p < 0.001$ ).



**Figure 2.** Student perceptions of the effects of research on their skill sets based on their research experience in Biology 211, upper level courses, or independent research experiences.

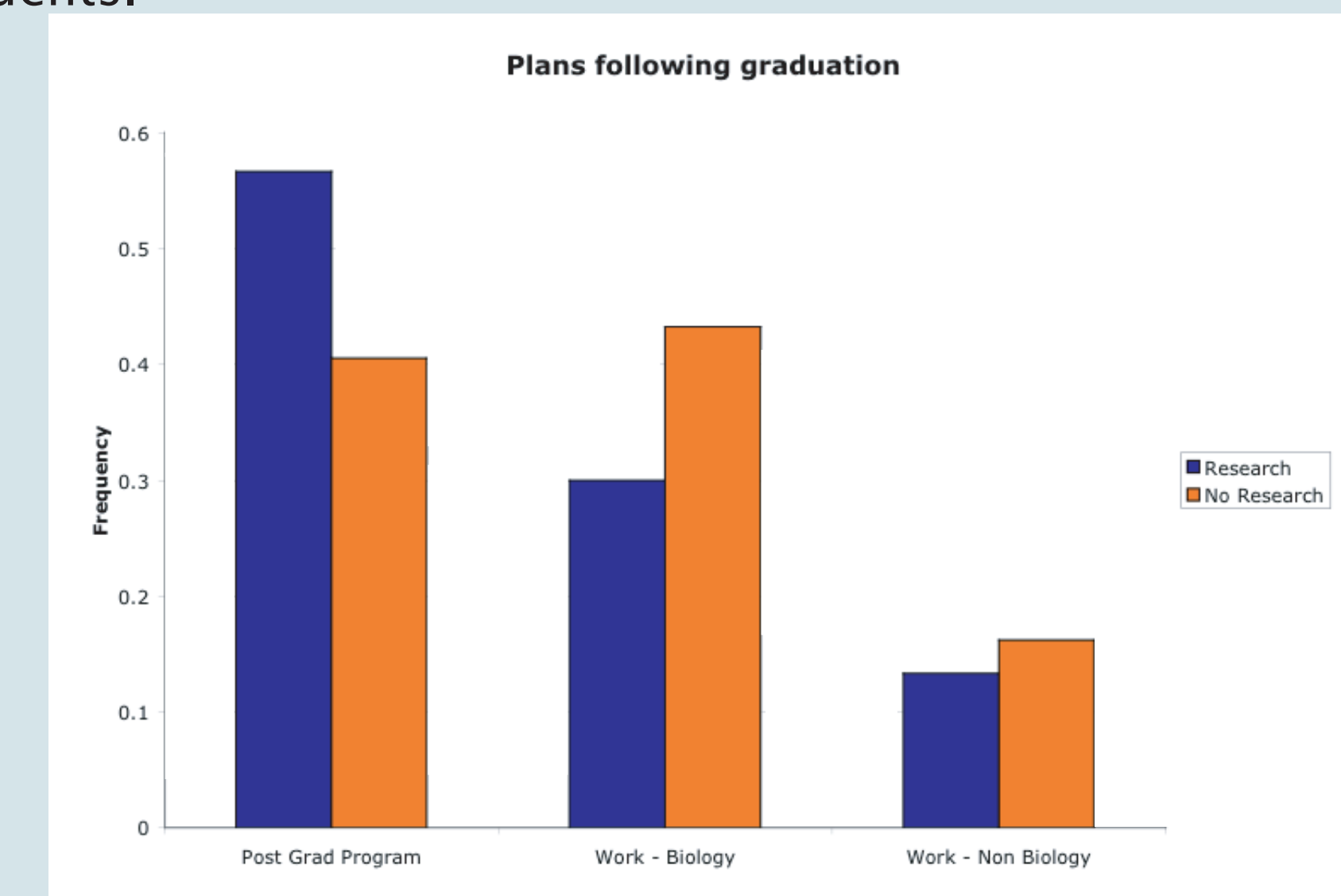
- A higher frequency of students who participated in independent research reported that their experience developed their problem solving skills, ability to work independently, time management skills, and their understanding of ethical issues compared to students who had not participated in independent research.

### Student perceptions of challenges to participating in independent research in the biology and B/MB programs

- Of the 105 students that indicated that they wished to be involved in independent research before graduation, 51% indicated that finding a faculty member with a research opening was a significant challenge. 51% of students also felt that they lacked the skills necessary to do research, and 50% of students had concerns it would affect their academic performance.

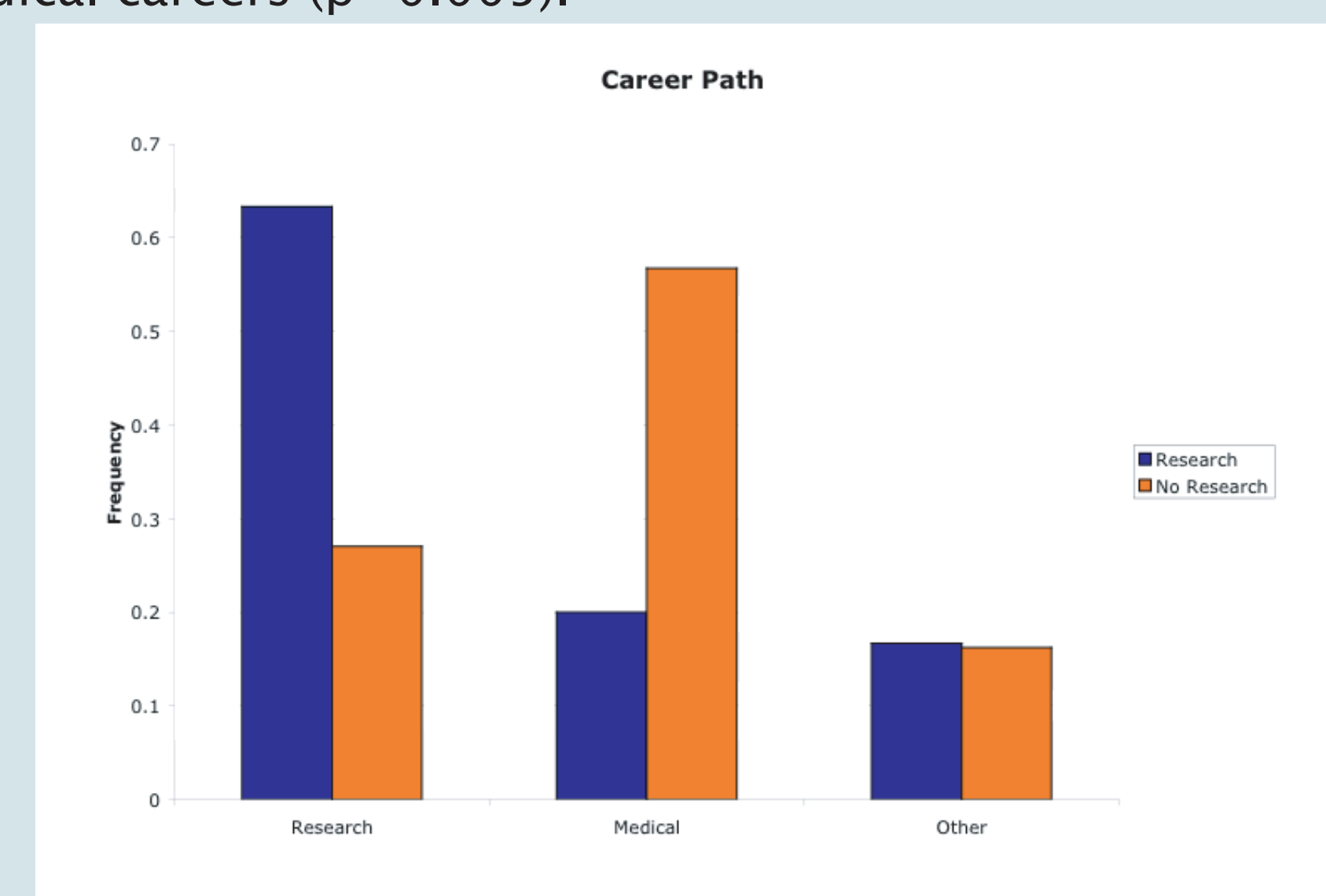
## The effects of undergraduate research experiences on post–graduate plans

- Of the 2009 biology and B/MB graduates, 56% of students who participated in undergraduate research experiences will be entering a post–graduate program, compared to only 40% of non–research students.



**Figure 3.** The plans of biology and B/MB majors matriculating in 2009 following graduation.

- A significantly greater number of research students are pursuing research–based careers than non–research students, while a significantly greater number of non–research students are pursuing medical careers ( $p = 0.005$ ).



**Figure 4.** The planned career paths of biology and B/MB majors matriculating in 2009.

## Conclusions and Recommendations

Based on our findings:

- A large majority of biology and B/MB students want to become involved in independent research
- Students who participated in independent research are more likely to enter into a post–graduate program than those who have not
- Independent research experiences were reported to be valuable compared to classroom instruction
- Independent research helped develop skills in problem solving, working independently, and time management

Furthermore, based on the data from our surveys, course–based research experiences are deficient compared to independent research experiences in building problem solving, time management, and oral communication skills. Likewise, course–based research experiences are also deficient in building student understanding of the ethical issues associated with research and strengthening student ability to work independently when compared to independent research experiences. This is not to say that course–based research experiences are not valuable to undergraduates, as students reported these experiences to have strengthened these areas; just to a much lesser extent than those students who participated in independent experiences. Therefore, it is our recommendation that further attention be placed on these areas of deficit, in designing and implementing course–based research experiences. We also recommend that, because course–based experiences do not substitute for the independent research experience as shown by our survey data, independent research opportunities within the biology and B/MB programs be evaluated and expanded to better meet student demand for such experiences.

Works Cited:  
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