IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Wind Energy Science, Engineering, and Policy Integrative Graduate Education and Research Traineeship (WESEP IGERT)

2016 Evaluation Report

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WESEP IGERT 2016 EVALUATION REPORT

Executive Summary

WESEP IGERT began in 2012. As of the ISU Fall Semester 2016, 24 students have matriculated as full time continuous WESEP PhD students. Six IGERT students have received their PhDs and 18 students are presently enrolled in WESEP, with 17 being IGERT Fellows. Two of the 18 will graduate in the Spring 2017. Twenty-five ISU faculty members from 10 departments and three colleges are affiliated with WESEP. This evaluation is based upon student and faculty surveys and individual interviews with WESEP students and faculty and ISU administrators. Most of the IGERT students have taken advantage of the International Opportunity.

In the student focus group and individual interviews, students discussed a variety of topics, noting program aspects that they particularly liked and also suggestions for improvement. The topic areas included: coursework, internships, graduate student climate, student community outreach and recruitment efforts, industry connections and employment, research and publications, and the WESEP IGERT program sustainability. Overall, students were pleased with their experiences in the WESEP IGERT program with several specific criticisms. Student responses and comments regarding the WESEP IGERT program are discussed in detail below.

Faculty and administrators discussed a variety of topics, noting elements that they particularly liked about the program and also made suggestions for program improvement. In 2016 there were 25 faculty members from 10 departments in 3 colleges engaged in WESEP. Overall, faculty expressed a high level of support for the WESEP IGERT program, and deemed it a valuable asset to the university and the field. They offered that the IGERT student Fellows were of exceptional quality, and felt the program was very well-managed by the IGERT PI and Co-PIs. Their survey and interview responses are provided below. Administrators were also enthusiastic about the program, made suggestions for program improvements, and responded favorably to program improvements that they could help facilitate. Suggestions for program improvement are discussed in detail below. The engagement of Statistics into WESEP has been viewed very favorably but there are some scheduling issues that must be addressed in order for the students to be able to advantage of both the WESEP and Statistics Curricula in a timely manner. Discussions are underway. Campus Administrators, including several academic Colleges and the Graduate College also indicated a willingness to discuss the continuation of WESEP, beyond its' NSF sponsored lifetime, given its success to date and its inter-disciplinary, cross-cutting campus-wide nature. The WESEP PI and Co-PIs are discussing possible engagement of NSF in the future.

It is of considerable note that the collective contingent of WESEP IGERT students has been very active in scholarly productivity and public outreach. Six of the students were either the primary author or a co-author of papers in the peer reviewed literature in the last year, and 12 of the students reported that they were an author or co-author on at least one manuscript currently in preparation. Eleven students reported that they had made at least

one conference paper/poster presentation in the last year, and eleven students reported that they were currently in preparation on at least one conference paper or poster presentation. Finally, the students have filed for three patents. These numbers speak to the quality of the WESEP-IGERT program and to the students enrolled in the WESEP.

The WESEP IGERT program faculty reported having vastly increased the number of times they reported serving as a primary author on a variety of publications from 2014 to 2015, including journal articles, conference presentations, books, patent applications, approved patents, grant proposals, and other publications. However, the faculty reported having decreased the number of times they served as a co-author on publications, including journal articles, conference presentations, book chapters, and grant proposals. The faculty also reported having decreased the number of times they worked with interdisciplinary authors/co-authors on publications such as journal articles, conference presentations, and grant proposals. However, this was the first year in which any of the WESEP IGERT faculty reported on having worked with interdisciplinary authors/co-authors on any patent applications and having received patents. Licensing agreements are in the offing. It is important to note the decrease in faculty productivity on collaborative and interdisciplinary work, in that one of the goals of IGERT program is to foster collaborative and interdisciplinary research. Issues related to the content, conduct and credit of WESEP 594 have been addressed and the course is now very well regarded by the students who are now receiving cumulative course credits.

In keeping with the discussions of and recommendations of the internal and external reviews of 2014 and 2015, the WESEP IGERT Fellows have developed an on-line incoming user friendly student information website. They then chose to expand that activity into the campus organization WESO, which has engaged 60 undergraduates at ISU into the campus "wind energy" enterprise and has developed a robust outreach program with the greater Ames community and the K-12 educational system of Ames. These activities have been supported by WESEP leadership

Introduction and Methodology

WESEP IGERT Program Background

The Integrative Graduate Education and Research Traineeship (IGERT) program has been developed by the U.S. National Science Foundation (NSF) to meet the challenges of educating U.S. Ph.D. scientists and engineers with interdisciplinary backgrounds, deep knowledge in chosen disciplines, and technical, professional, and personal skills. The program is intended to establish new models for graduate education and training in a fertile environment for collaborative research that transcends traditional disciplinary boundaries. It is also intended to facilitate diversity in student participation and preparation, and to contribute to a world-class, broadly inclusive, and globally engaged science and engineering workforce.

Building upon the NSF IGERT platform, the purpose of the IGERT Graduate Program in Wind Science, Engineering and Policy (WESEP) at Iowa State University, in collaboration with the University of Puerto Rico-Mayaguez, is to provide doctoral students with multi-

disciplinary training in the skills required for conducting research at the disciplinary interface between wind engineering and technology, atmospheric science - meteorology, agriculture - economics, journalism – communication and public policy. The WESEP program is a new model in graduate education in which students are engaged in an environment that supports innovation to learn through hands - on experience how their own research may contribute in new ways to benefit society and to learn the processes for the successful implementation of such contributions.

Evaluation Methods and Procedures

As a key part of the annual evaluation of the program, students enrolled in the WESEP IGERT program are asked annually to fill out a survey related to their experiences in the program and research productivity. This survey was distributed in August 2016. All 17 students currently enrolled in the program completed the survey. Another student involved in the WESEP program, but who is not an IGERT fellow, also completed the survey. One additional student was recruited to the WESEP IGERT program last January but has since left the program – this student was invited to participate in the survey but did not respond to the survey invitation.

As a separate but related component of the annual programmatic evaluation process, an annual survey for faculty engaged in the program was distributed in August 2016 and reflects the responses of eight of the 25 faculty who are affiliated with the program as "WESEP Faculty" and have been involved in a variety of ways in the academic program.

The external evaluator reviewed all data collected. He performed in person, on-campus interviews with 1) 17 of the WESEP IGERT fellows (including three program alums) in person and on campus and the one WESEP student who is not an IGERT fellow, 2) eight selected faculty members, 3) six administrators including three department chairs and three college deans, and 4) the Director of the Wind Energy Systems Lab. The evaluation team focused on constructive critiques, conclusions, and recommendations regarding the present and future effectiveness of the program. Detailed notes of the discussions held during the interviews and with the focus groups were recorded during and immediately following the discussions. Analyses of these discussions were based on an objective assessment of the overall content of the perceptions of the students, faculty and administrators.

The evaluation questions were intended to assess student and faculty perceptions of the program. The evaluations questions were related to student recruiting methods, multi-disciplinary efforts; inter-institutional efforts; training and mentoring; the Real Time Research Collaborative (the RTRC); interdisciplinary features; student progress, skills, student achievements in the program including scholarly research and activities on the national to international stage; career placement for graduates; community impacts; and program sustainability.

Focus groups and interviews were conducted with 17 students, eight faculty, and six university administrators involved with the program. The interviews with students, faculty, and university administrators averaged thirty minutes in length. Additionally, the students participated in a one-hour focus group discussion.

Results

The results are presented below in four sections: 2.1) Annual student survey; 2.2) Annual faculty survey; 3) Student focus groups and interviews; and 4) Faculty focus groups and interviews. Each of these sections is further broken down into subsections in order to group similar questions and organize the data to aid in the understanding of the IGERT program.

Annual Student Survey

This section of the report details students' responses to the annual student survey and is broken down into three subsections: 2.1.1) Program Activities, 2.1.2) Research, Publications, and Other Scholarly Activity, and 2.1.3) Learning, Preparation, and Suggestions for Improvement. Each of these subsections is comprised of similar questions. All 18 students are currently enrolled in the WESEP program completed the survey, including one student who is not an IGERT fellow because of the NSF requirement that students must be domestic. Survey respondents included two students who entered the program in 2012, six students who entered the program in 2013, three students who entered the program in 2014, three students who entered the program in 2015, and four students who entered the program in 2016. Not all of the students responded to every question.

Student Program Activities

This section details students' activities within the WESEP IGERT program. Specifically, students were asked to respond to three questions related to formal training they had received in the program, types of collaborators with whom they were working, and types of internships that they may have participated in as part of the program.

Table 1 addresses formal training received by the students. All students in the 2012 and 2013 cohorts reported that they had received formal training in the responsible conduct of research, statistics, communicating to people outside the home discipline, and communicating to the general public. At least half of the students in each of the 2012 and 2013 and cohorts reported that they had also received training in bridge courses to learn background content knowledge outside their field, research methods, professional speaking/presentation skills, professional writing, and working on a research team project. No students in the 2012 cohort reported receiving formal training related to state of the art instrumentation, as the Wind Energy Systems lab had not been created at the onset of the program. At least half of the WESEP students reported that they had received training in each of the areas listed. As shown in Figure 1, the proportion of students reporting that they had received formal training in each area remained fairly consistent from the 2013 annual survey to the 2016 annual survey. Taking the area 10 items collectively, the 2012 cohort reported receiving 75% of these formal training opportunities, the 2013 cohort reported receiving 92%, the 2014 cohort reported receiving 40%, the 2015 cohort reported receiving 50%, and the 2016 cohort reported receiving 48%. The 2012 cohort may have suffered program ramp-up issues with the 2013 cohort expressing uniformly excellent responses. Thus, given the 2013 cohort response and those thereafter, having all students in every cohort reporting receiving training in each of these areas is an attainable goal.

Table 1: Formal Training Received

	2012 Cohort n	2012 Cohort (%)	2013 Cohort n	2013 Cohort (%)	2014 Cohort n	2014 Cohort (%)	2015 Cohort n	2015 Cohort (%)	2016 Cohort n	2016 Cohort (%)
Responsible conduct of research (ethics)	2	100.0	6	100.0	2	66.7	1	33.3	2	50.0
Statistics	2	100.0	6	100.0	0	0.0	3	100.0	2	50.0
“Bridge” courses to learn background content knowledge outside your field	1	50.0	6	100.0	2	66.7	3	100.0	2	50.0
Research methods	1	50.0	6	100.0	0	0.0	3	100.0	2	50.0
State-of-the-art instrumentation	0	0.0	5	83.3	1	33.3	1	33.3	2	50.0
Professional speaking/presentation skills	1	50.0	5	83.3	2	66.7	0	0.0	2	50.0
Communicating to people outside your home discipline	2	100.0	6	100.0	1	33.3	1	66.7	2	50.0
Professional writing	2	100.0	4	66.7	1	33.3	1	33.3	1	25.0
Communicating to the general public	2	100.0	6	100.0	2	66.7	0	0.0	2	50.0
Working on a research team project	2	100.0	5	83.3	1	33.3	2	66.7	2	50.0

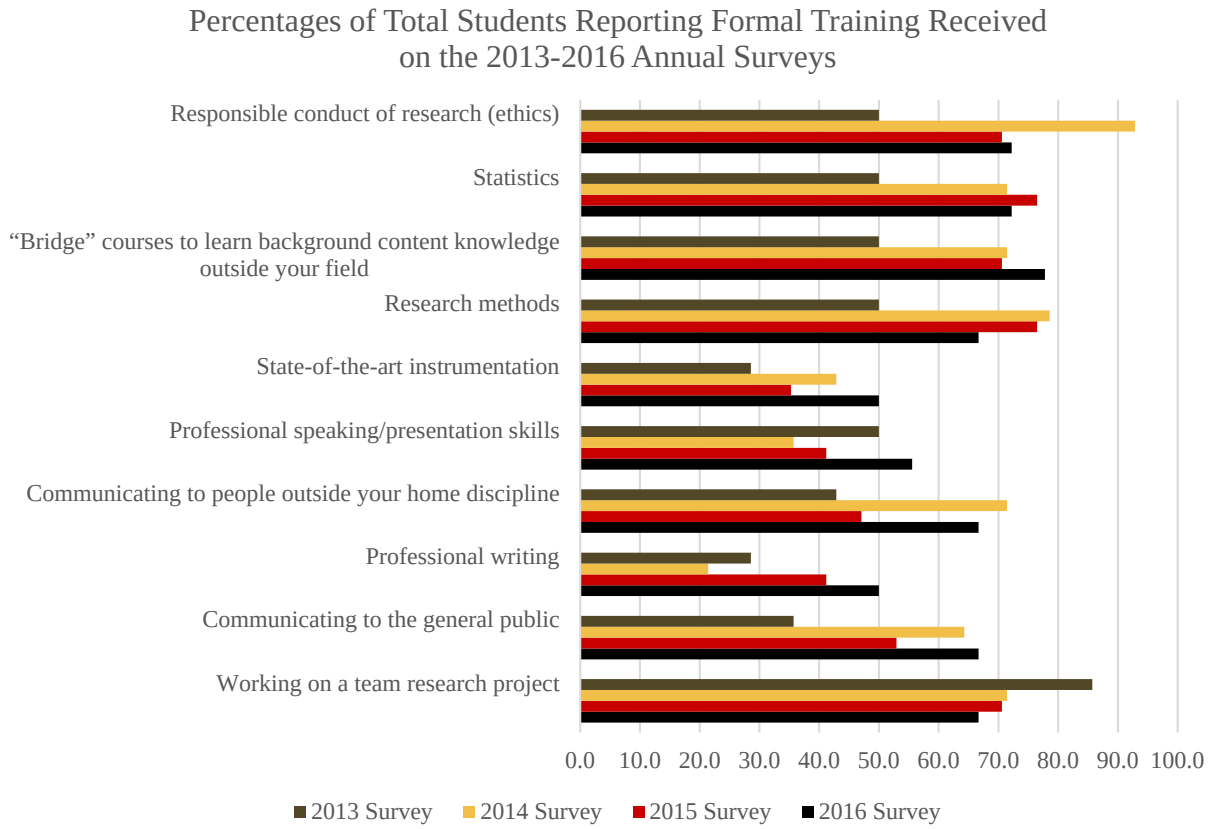

Figure 1. Percentages of total students reporting formal training received on 2013-2016 annual surveys. (2013 n = 14, 2014 n = 14, 2015 n = 17, 2016 n = 18).

Students were asked about the types of collaborators they were working with during their graduate education in the WESEP IGERT program (Table 2). All WESEP students reported that they were collaborating with ISU faculty in their home department. Over half of all students reported collaborations in other departments at ISU. As shown in Figure 2, 2016 was the first year that any students reported working with government laboratory scientists on the ISU campus, and two students reported doing so this year. The percentage of students reporting collaborations with public/government laboratory scientists in the US also increased dramatically.

Table 2: Students' Collaborators

	2012 Cohort n	2012 Cohort (%)	2013 Cohort n	2013 Cohort (%)	2014 Cohort n	2014 Cohort (%)	2015 Cohort n	2015 Cohort (%)	2016 Cohort n	2016 Cohort (%)
Faculty at my institution in my home department	2	100.0	6	100.0	3	100.0	3	100.0	4	100.0
Faculty at my institution in other departments	1	50.0	5	83.3	2	66.7	1	33.3	1	25.0
Faculty at other universities in the United States	0	0.0	1	16.7	2	66.7	1	33.3	1	25.0
International faculty members	2	100.0	3	50.0	2	66.7	0	0.0	0	0.0
Government laboratory scientists on the ISU campus	0	0.0	1	16.7	0	0.0	0	0.0	1	25.0
Industrial scientists in Iowa	1	50.0	1	16.7	0	0.0	0	0.0	0	0.0
Industrial scientists in the United States (outside of Iowa)	1	50.0	1	16.7	0	0.0	1	33.3	0	0.0
International industrial scientists	1	50.0	1	16.7	1	33.3	0	0.0	0	0.0
Public/government laboratory scientists in the United States	1	50.0	1	16.7	2	66.7	1	33.3	2	50.0
International public/government laboratory scientists	0	0.0	0	0.0	1	33.3	0	0.0	0	0.0
Policymakers or planners	0	0.0	0	0.0	2	66.7	1	33.3	0	0.0
Other scholars or consultants	0	0.0	0	0.0	1	33.3	1	33.3	0	0.0

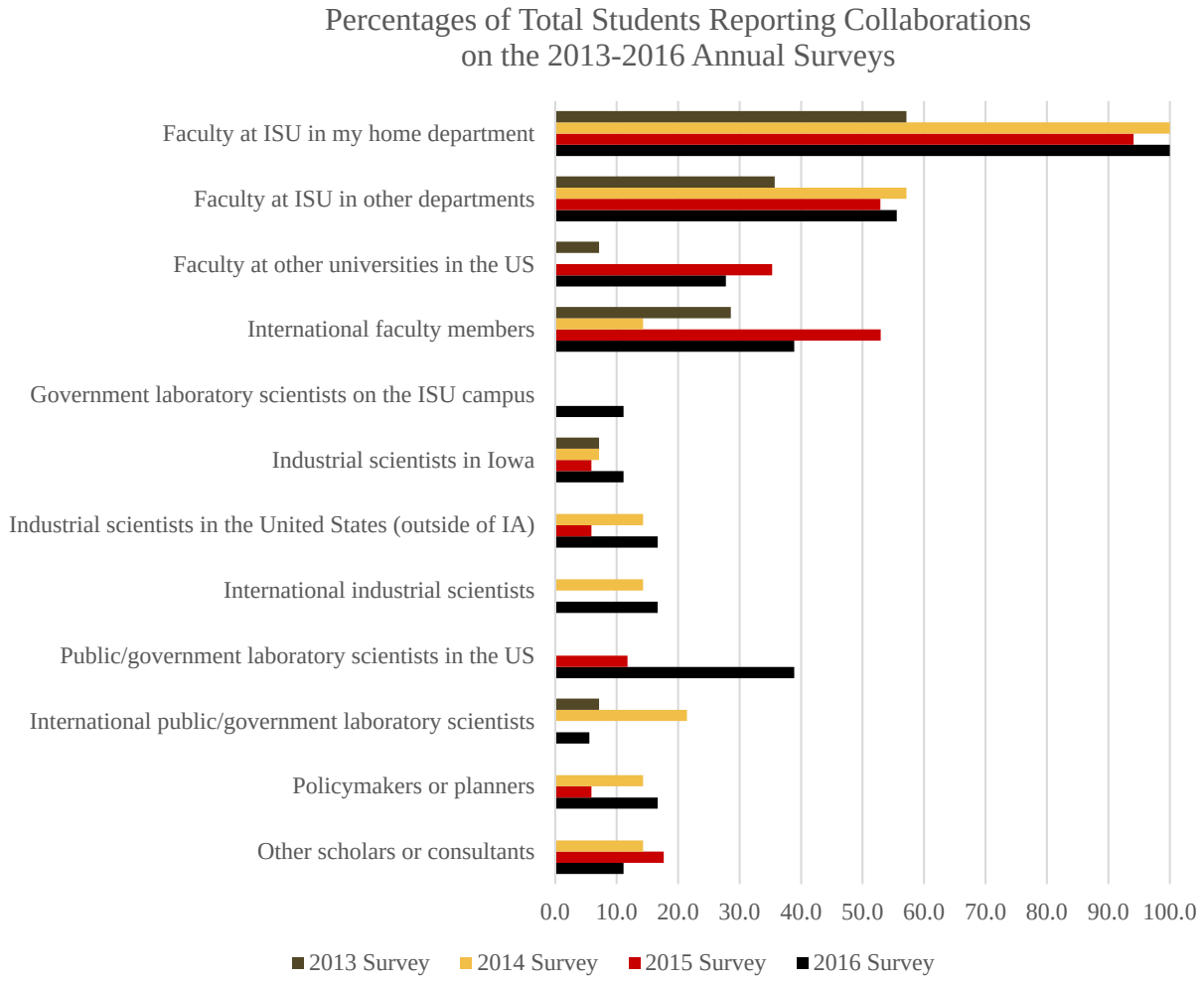

Figure 2. Percentages of total students reporting collaborations on 2013-2016 annual surveys. (2013 n = 14, 2014 n = 14, 2015 n = 17, 2016 n = 18).

Students were also asked about the types of internships in which they had participated as part of the WESEP IGERT program (Table 3). Both students from the 2012 cohort and two of the six students from the 2013 cohort indicated that they had participated in an internship though the WESEP IGERT program, though no students from the 2014, 2015, or 2016 cohorts had participated in an internship at this point in the program. Of the four students who had participated in internships, two reported private sector industry internships and two reported an internship with a public sector laboratory or agency. The proportions of students who had participated in internships as part of the WESEP IGERT program at the time of the 2016 annual survey remained relatively similar to the proportions of students who had participated in internships at the time of the 2014 and 2015 annual surveys (Figure 3).

Table 3: Internships in which Students Participated

	2012 Cohort n	2012 Cohort (%)	2013 Cohort n	2013 Cohort (%)	2014 Cohort n	2014 Cohort (%)	2015 Cohort n	2015 Cohort (%)	2016 Cohort n	2016 Cohort (%)
Private sector industry	2	100.0	0	0.0	0	0.0	0	0.0	0	0.0
Business	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
Public sector laboratories or agencies	0	0.0	2	33.3	0	0.0	0	0.0	0	0.0
I have not yet participated in an internship as part of the IGERT program	0	0.0	4	66.7	3	100.0	3	100.0	4	100.0

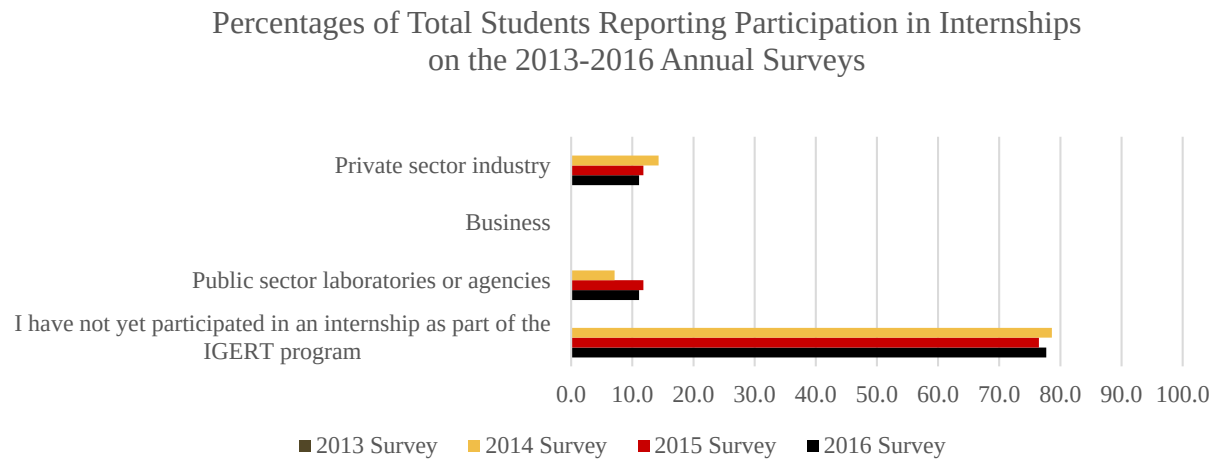

Figure 3. Percentages of total students reporting collaborations on 2013-2016 annual surveys. (2013 n = 14, 2014 n = 14, 2015 n = 17, 2016 n= 18).

Student Research, Publications and Other Scholarly Activity

Students were asked to respond to eight closed-ended response items related to research and publications. Specifically, they were asked about their participation in collaborative research projects, interdisciplinary research publications, number of research publications, the conferences and workshops attended, and the usefulness of the RTRC.

As shown in Table 4, students were asked to indicate what types of collaborative research projects they had worked on as part of the WESEP IGERT program. Fourteen of the 18 students reported working on a research project involving multiple disciplines, and 14 students had worked on a team research project. Eleven students reported working on a research project with students who shared a disciplinary background similar to their own, and 11 students reported working on a research project with students with disciplinary backgrounds different from their own. Percentages of students engaged in each of these activities in 2013, 2014, 2015, and 2016 has remained fairly consistent, with a steady increase seen in the percentage of students who report working on a research project involving multiple disciplines (Figure 4).

Table 4: Collaborative Research Projects

	2012 Cohort n	2012 Cohort (%)	2013 Cohort n	2013 Cohort (%)	2014 Cohort n	2014 Cohort (%)	2015 Cohort n	2015 Cohort (%)	2016 Cohort n	2016 Cohort (%)
Working on a research project involving multiple disciplines	2	100.0	5	83.3	2	66.7	1	33.3	4	100.0
Working on a research project with other students who share a similar disciplinary background to my own	1	50.0	4	66.7	2	66.7	2	66.7	2	50.0
Working on a team research project	2	100.0	5	83.3	3	100.0	2	66.7	2	50.0
Working on a research project with other students with disciplinary backgrounds different from my own	2	100.0	4	66.7	2	66.7	2	66.7	1	25.0

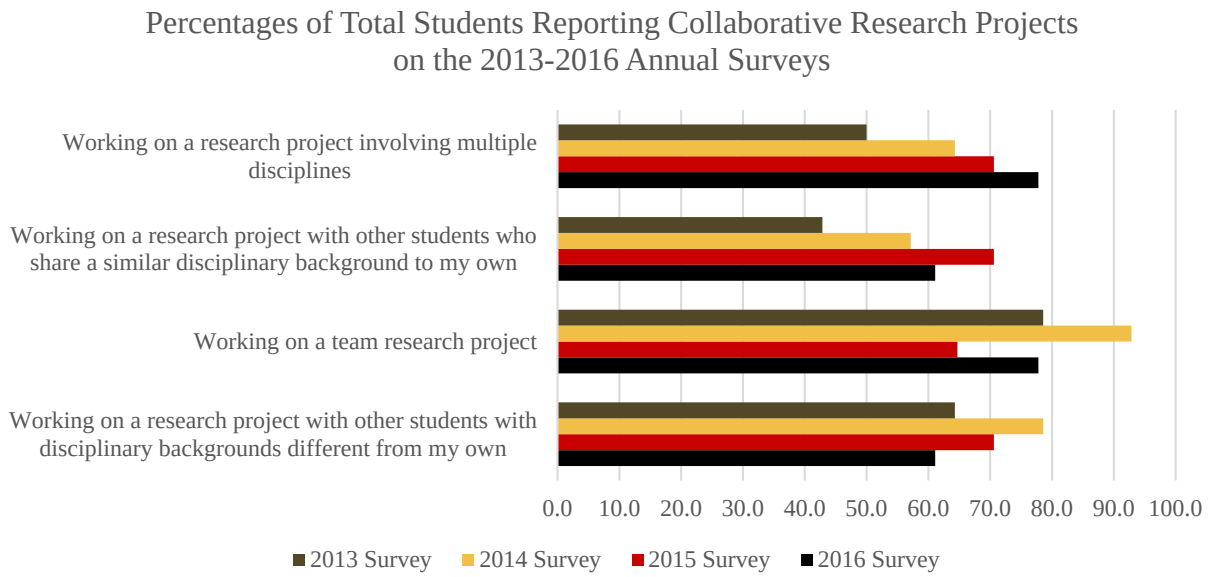

Figure 4. Percentages of total students reporting collaborative research projects on 2013-2016 annual surveys. (2013 n = 14, 2014 n = 14, 2015 n = 17, 2016 n = 18).

As shown in Table 5, two WESEP IGERT students reported that they had presented research findings at a conference outside their home discipline in the last year, and three WESEP IGERT students reported publishing research findings in journal outside their home discipline in the last year. As shown in Figure 5, more students reported engaging in these activities in 2015 and 2016 than in the previous two years, though more students reported presenting research findings at a conference outside their home disciplines in 2015 than in 2016.

Table 5: Interdisciplinary Research Publications

	2012 Cohort n	2012 Cohort (%)	2013 Cohort n	2013 Cohort (%)	2014 Cohort n	2014 Cohort (%)	2015 Cohort n	2015 Cohort (%)	2016 Cohort n	2016 Cohort (%)
Published research findings in a journal outside your home discipline.	0	0.0	1	16.7	1	33.3	0	0.0	1	25.0
Presented research findings at a conference outside your home discipline.	1	50.0	0	0.0	0	0.0	0	0.0	1	25.0

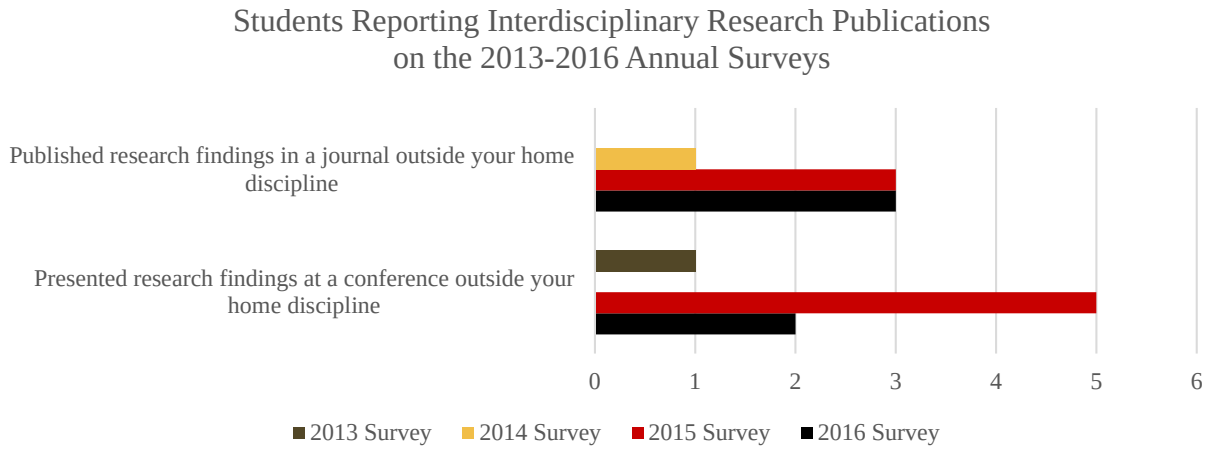

Figure 5. Students reporting interdisciplinary research publications on the 2013-2016 annual surveys. (2013 n = 14, 2014 n = 14, 2015 n = 17, 2016 n = 18).

Table 6 displays reported student publications and presentations related to wind energy that were completed in the last year. Three students reported serving as the primary author on a journal article, and one student reported serving as a co-author on a journal article. Students also reported serving as a primary author on a conference paper or poster presentation 16 times, a co-author on a conference paper or poster eight times, a primary author on a grant proposal twice, and a coauthor on a grant proposal twice. One student reported serving as the primary author on a patent application. As shown in Figure 6, the number of times students reported serving as a primary author on a journal article or conference presentation increased in 2016, though the number of times they served as a coauthor on journal articles or conference presentations slightly decreased.

Table 6: Student Research Publications, Conferences and Other Scholarly Activity

	2012 Cohort			2013 Cohort			2014 Cohort			2015 Cohort			2016 Cohort		
	n	mean	s.d.	n	mean	s.d.	n	mean	s.d.	n	mean	s.d.	n	mean	s.d.
Journal articles in refereed journals															
Primary Author	1	0.50	0.707	1	0.17	0.408	1	0.33	0.577	0	0.00	-	0	0.00	-
Co-author	0	0.00	-	1	0.17	0.408	0	0.00	-	0	0.00	-	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-	0	0.00	-	1	0.33	0.577	0	0.00	-	0	0.00	-
In process	1	0.50	0.707	12	2.00	1.265	7	2.33	0.577	2	0.67	1.15	1	0.25	0.500
Conference paper or poster presentations															
Primary Author	1	0.50	0.707	6	1.00	1.095	8	2.67	1.528	1	0.33	0.577	0	0.00	-
Co-author	0	0.00	-	5	0.83	0.753	3	1.00	1.000	0	0.00	-	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-	2	0.33	0.516	1	0.33	0.577	0	0.00	-	0	0.00	-
In process	2	1.00	0.000	5	0.83	1.169	3	1.00	1.000	0	0.00	-	1	0.25	0.500
Book chapters															
Primary Author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Co-author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
In process	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Books															
Primary Author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Co-author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
In process	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Patent applications															
Primary Author	0	0.00	-	0	0.00	-	1	0.33	0.577	0	0.00	-	0	0.00	-
Co-author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-	1	0.17	0.408	0	0.00	-	0	0.00	-	0	0.00	-
In process	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-

Table 6: Student Research Publications, Conferences and Other Scholarly Activity (con't)

	2012 Cohort			2013 Cohort			2014 Cohort			2015 Cohort			2016 Cohort		
	n	mean	s.d.	n	mean	s.d.	n	mean	s.d.	n	mean	s.d.	n	mean	s.d.
Approved patents															
Primary Author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Co-author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
In process	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Grant proposals															
Primary Author	1	0.50	0.707	0	0.00	-	1	0.33	0.577	0	0.00	-	0	0.00	-
Co-author	1	0.50	0.707	1	0.17	0.408	0	0.00	-	0	0.00	-	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-	1	0.17	0.408	0	0.00	-	0	0.00	-	0	0.00	-
In process	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
All other publications															
Primary Author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Co-author	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-	0	0.00	-
In process	0	0.00	-	1	0.17	0.408	0	0.00	-	0	0.00	-	0	0.00	-

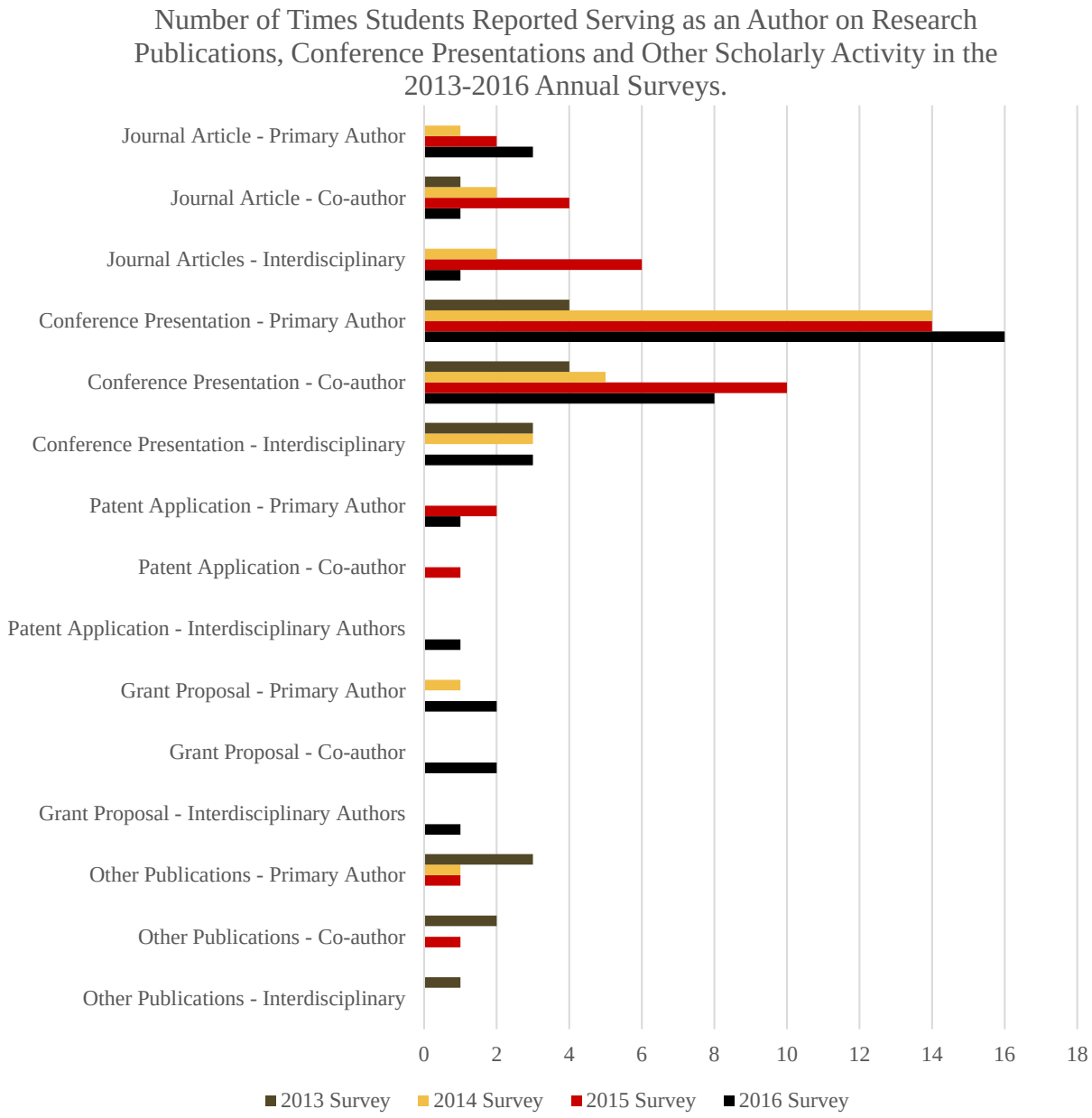

Figure 6. Number of times students reported serving as an author on research publications, conference presentations and other scholarly activity in the 2013-2016 annual surveys. (2013 n = 14, 2014 n = 14, 2015 n = 17, 2016 n = 18). Book chapters, books, and approved patents are not included in the table as students have not yet reported engaging in these types of research activities in any of the annual surveys conducted.

Table 7 addresses conferences and workshops that WESEP IGERT students attended and/or presented at. A total of 14 of the WESEP IGERT students reported that they had attended a conference at ISU, 12 had attended a conference within the U.S. (outside of ISU), and two attended an international conference. Thirteen students presented a poster at ISU, eight presented a poster within the U.S., and one student presented a poster outside of

the U.S. One student presented a paper at ISU, four presented a paper within the U.S., and two presented a paper internationally. As shown in Figure 7, student conference presentation rates had increased at the time of the 2016 survey, although student paper presentation rates had decreased from the time of the 2015 survey to the time of the 2016 survey.

Table 7: Conferences and Workshops Attended

	2012 Cohort n	2012 Cohort (%)	2013 Cohort n	2013 Cohort (%)	2014 Cohort n	2014 Cohort (%)	2015 Cohort n	2015 Cohort (%)	2016 Cohort n	2016 Cohort (%)
Attended a conference										
At ISU	2	100.0	4	66.7	3	100.0	2	66.7	3	75.0
Within the U.S.	1	50.0	5	83.3	3	100.0	1	33.3	2	50.0
Outside the U.S.	0	0.0	2	33.3	0	0.0	0	0.0	0	0.0
Presented a poster										
At ISU	2	100.0	4	66.7	2	66.7	2	66.7	3	75.0
Within the U.S.	1	50.0	2	33.3	2	66.7	1	33.3	2	50.0
Outside the U.S.	0	0.0	1	16.7	0	0.0	0	0.0	0	0.0
Presented a paper										
At ISU	0	0.0	0	0.0	0	0.0	0	0.0	1	25.0
Within the U.S.	0	0.0	2	33.3	1	33.3	0	0.0	1	25.0
Outside the U.S.	0	0.0	2	33.3	0	0.0	0	0.0	0	0.0

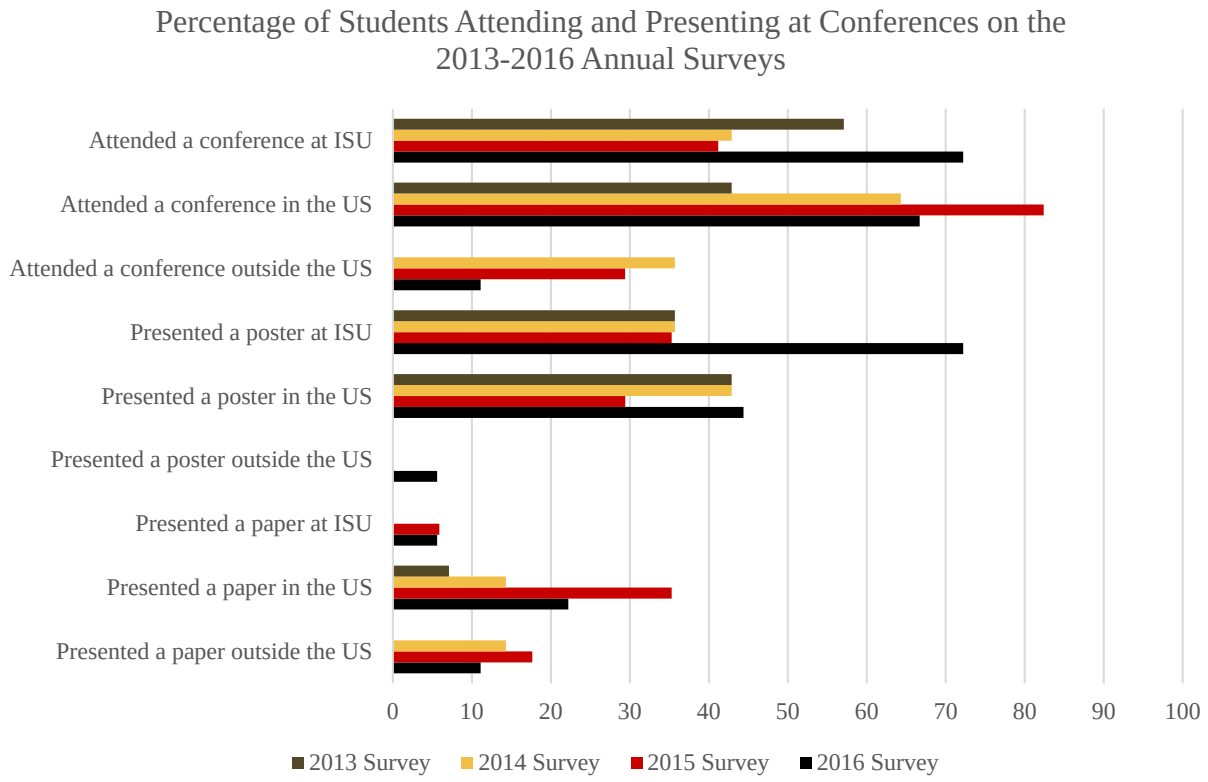

Figure 7. Percentage of students attending and presenting at conferences in the 2013-2016 annual surveys. (2013 n = 14, 2014 n = 14, 2015 n = 17, 2016 n = 18).

Students from the 2012, 2013, and 2015 cohorts were asked about the usefulness of WESEP 594: the RTRCs (Table 8). Fall 2016 students were not included due to limited exposure to the RTRC, one of the remaining 2016 students did not respond to the question, and the last 2016 student was not included in the table for confidentiality reasons. On average, students indicated that the RTRC was "somewhat useful," reporting that it was most useful for learning about environmental and policy issues, and less useful for making interdisciplinary connections. Interestingly, the RTRC was also rated less useful for enhancing students' communication skills, particularly by 2012 cohort students. As shown in Figure 8, students have tended to rate the RTRC fairly consistently over the past four years. The students reported that the RTRC was more useful in making industry connections in 2014 and 2015 than in other years. Overall, 2012 cohort students rated the RTRC at 2.8, 2013 cohort students rated it 3.1, 2014 cohort students rated it 3.1, and 2015 cohort students rated it at 2.8.

Table 8: Usefulness of the WESEP 594: Real Time Research Collaborative

	2012 Cohort			2013 Cohort			2014 Cohort			2015 Cohort		
	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.
Learning how to do research	2	3.50	0.707	6	3.00	0.632	3	3.00	1.000	3	3.33	0.577
Stimulating and enhancing your research productivity	2	3.00	1.414	6	2.50	1.225	3	3.33	1.155	3	3.00	1.000
Facilitating your interdisciplinary work	2	2.00	1.414	6	3.33	0.816	3	3.00	1.000	3	2.33	1.155
Enhancing your communication skills	2	1.50	0.707	6	3.33	1.211	3	2.67	1.155	3	2.67	1.528
Enhancing your awareness of and ability to respond to ethical issues	2	3.50	0.707	6	3.50	0.837	3	3.33	0.577	3	2.33	1.155
Learning about environmental and policy issues	2	3.50	0.707	6	3.50	0.837	3	3.67	0.577	3	3.33	1.155
Making industry connections	2	2.50	0.707	6	2.17	1.169	3	2.67	1.155	3	2.67	1.528

Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful
Fall 2016 cohort students were not included in this table due to limited exposure to the RTRC. One of the other 2016 cohort students did not respond to the question, so the remaining 2016 cohort student is not included for confidentiality reasons.

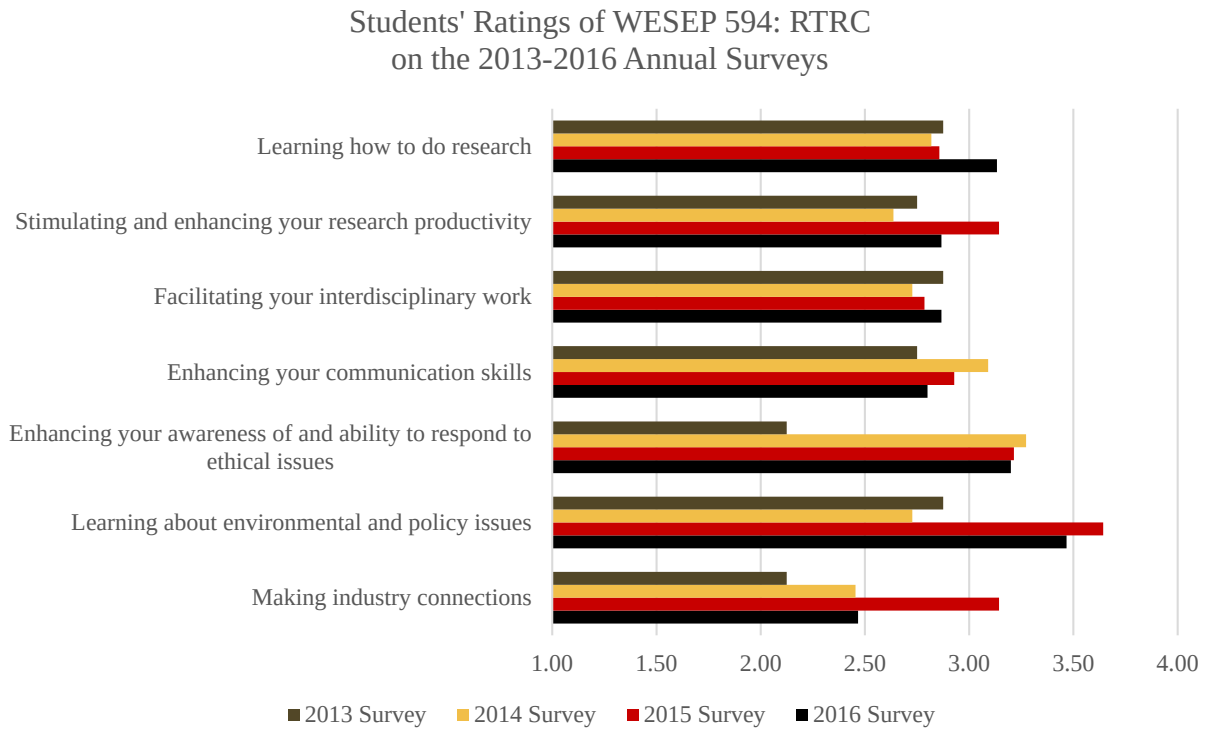

Figure 8. Students' ratings of WESEP 594: RTRC in the 2013-2016 annual surveys. (2013 n = 8, 2014 n = 11, 2015 n = 14, 2016 n = 15). Students entering the program the fall semester that the survey was administered are not included in this table due to their limited exposure to the WESEP 594 at the time of the survey. Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful.

Student Learning, Preparation, and Suggestions for Improvement

Students were asked three closed-ended response items related to their perceptions of their individual preparedness, the opportunities provided by their graduate program, and their career plans and perceptions of preparedness. Students were asked to provide suggestions for improving the IGERT program, and students planning to graduate within a year were asked about their graduation plans, the highlights of their experiences of the program, and any aspects of the program that might be lacking.

Table 9 displays students' reported perceptions of their preparedness to engage in a variety of academic and research-related activities. Overall, students rated themselves highly in each of the areas listed, and on average, indicated that they were at least somewhat prepared in each area. On average, students felt most prepared to conduct research in an ethical manner, though they also reported a high degree of preparedness to communicate with people inside their field and work outside of academia. Students reported that they were least prepared to write research articles or books. As shown in Figure 9, students rated themselves higher in eight of these areas on the 2016 survey as compared to the 2015 survey and lower in five areas on the 2016 survey as compared to the 2015 survey. Collectively the 2012 cohort rated their preparedness at 3.9, the 2013 cohort rated their preparedness at 4.2, the 2014 cohort rated their preparedness at 3.9, the 2015 cohort rated

their preparedness at 3.6, and the 2016 cohort rated their preparedness at 4.0; all between high “somewhat prepared” to “mostly prepared”.

Table 9: Students' Perceptions of Preparedness

	2012 Cohort			2013 Cohort			2014 Cohort			2015 Cohort			2016 Cohort		
	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.
Conduct high-quality research	2	4.00	0.000	6	4.00	0.632	3	4.33	0.577	3	3.33	0.577	4	4.25	0.500
Communicate with people inside your field	2	4.00	0.000	6	4.33	0.516	3	4.00	1.000	3	4.00	1.000	4	4.25	0.500
Understand and work in an academic setting	2	3.50	0.707	6	4.17	0.408	3	4.00	1.000	3	3.33	0.577	4	4.50	0.577
Conduct research in an ethical manner	2	4.50	0.707	6	4.50	0.548	3	4.00	1.000	3	4.00	1.000	4	4.25	0.957
Present research findings to scientific peers	2	4.00	0.000	6	4.17	0.408	3	4.00	0.000	3	3.67	1.155	4	4.00	0.816
Know your discipline in depth	2	4.00	0.000	6	4.33	0.516	3	3.67	0.577	3	3.33	0.577	4	4.00	0.816
Work in teams of researchers from more than one discipline	2	4.00	0.000	6	4.50	0.837	3	3.67	0.577	3	3.67	1.155	4	4.25	0.500
Work in research teams within your discipline	2	3.50	0.707	6	4.83	0.408	3	3.67	0.577	3	3.67	0.577	4	4.25	0.500
Collaborate with international scientists	2	4.00	0.000	6	4.33	0.816	3	3.67	0.577	3	3.00	0.000	4	3.00	1.414
Write research articles or books	2	4.00	0.000	6	3.67	0.516	3	3.67	1.155	3	3.33	0.577	4	3.50	1.291
Communicate with people outside your field	2	3.50	0.707	6	4.00	0.000	3	3.67	0.577	3	3.33	0.577	4	4.00	0.816
Communicate research findings to the general public	2	3.50	0.707	6	3.67	0.816	3	3.67	0.577	3	3.67	1.155	4	4.00	0.816
Work outside of academia (industry, public sector)	2	5.00	0.000	6	4.00	0.632	3	4.33	0.577	3	4.00	1.000	4	4.00	1.155

Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared

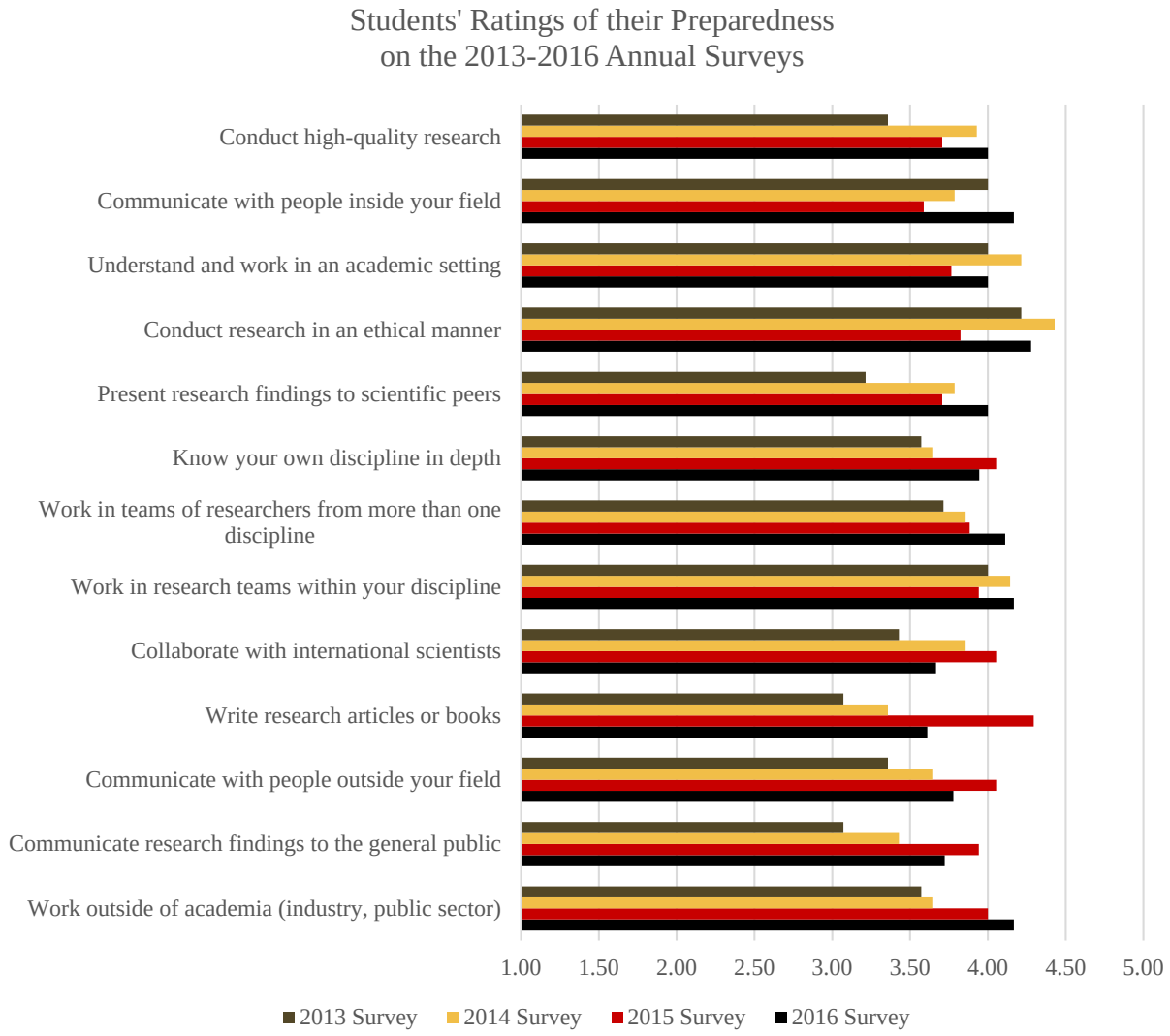

Figure 9. Students' ratings of their preparedness in the 2013-2016 annual surveys. (2013 n = 14, 2014 n = 14, 2015 n = 17, 2016 n = 18). Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared.

In Table 10 students' perceptions of the IGERT WESEP program are presented. Overall, the majority of students reported a high level of agreement with each of the items presented. Students agreed most strongly that they were able to study their field in as much depth as they liked and that they experience high demands on their time from their academic program. They agreed least that they were familiar with research being conducted in their field in foreign countries. As shown in Figure 10, students have tended to respond similarly to these items across survey years. In the 2016 survey, students were somewhat less likely to agree that they were familiar with current research being conducted in their field in foreign countries and that they received adequate opportunities to network with researchers outside the university. Overall, however, the students feel that they are highly "somewhat" to "mostly" prepared with overall averages of: 4.3 for the 2012 cohort students; 4.1 for the 2013 cohort students; 4.0 for the 2014 cohort students; 3.7 for the 2015 cohort students; and 3.8 for the 2016 cohort students.

Table 10: Students' Perceptions of their Graduate Program

	2012 Cohort			2013 Cohort			2014 Cohort			2015 Cohort			2016 Cohort		
	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.
I am able to study my field in as much depth as I like.	2	5.00	0.000	6	4.33	0.516	3	4.00	1.000	3	4.33	0.577	4	4.25	0.500
I have developed the ability to communicate and work on research problems with researchers from more than one discipline.	2	4.50	0.707	6	4.17	0.408	3	4.33	0.577	3	4.00	1.000	4	4.00	0.816
I experience high demands on my time from my academic program.	2	5.00	0.000	6	4.33	0.816	3	4.00	0.000	3	4.33	0.577	4	4.00	0.816
I receive adequate opportunities to network with researchers outside this university.	2	4.50	0.707	6	3.33	1.366	3	4.00	0.000	3	3.00	1.000	4	3.50	1.000
I am familiar with current research being conducted in my field in foreign countries.	2	3.50	0.707	6	3.83	0.983	3	4.00	0.000	3	2.67	1.528	4	2.00	0.816
I have been prepared to conduct research outside my institution.	2	4.00	1.414	6	4.17	0.408	3	4.33	0.577	3	3.33	0.577	4	4.00	0.816
I am being prepared for a wide range of career possibilities.	2	4.00	0.000	6	3.67	1.033	3	4.00	0.000	3	4.33	0.577	4	4.25	0.500
I am part of a strong student community.	2	4.00	0.000	6	4.67	0.516	3	3.67	1.528	3	3.67	1.528	4	4.25	0.500

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

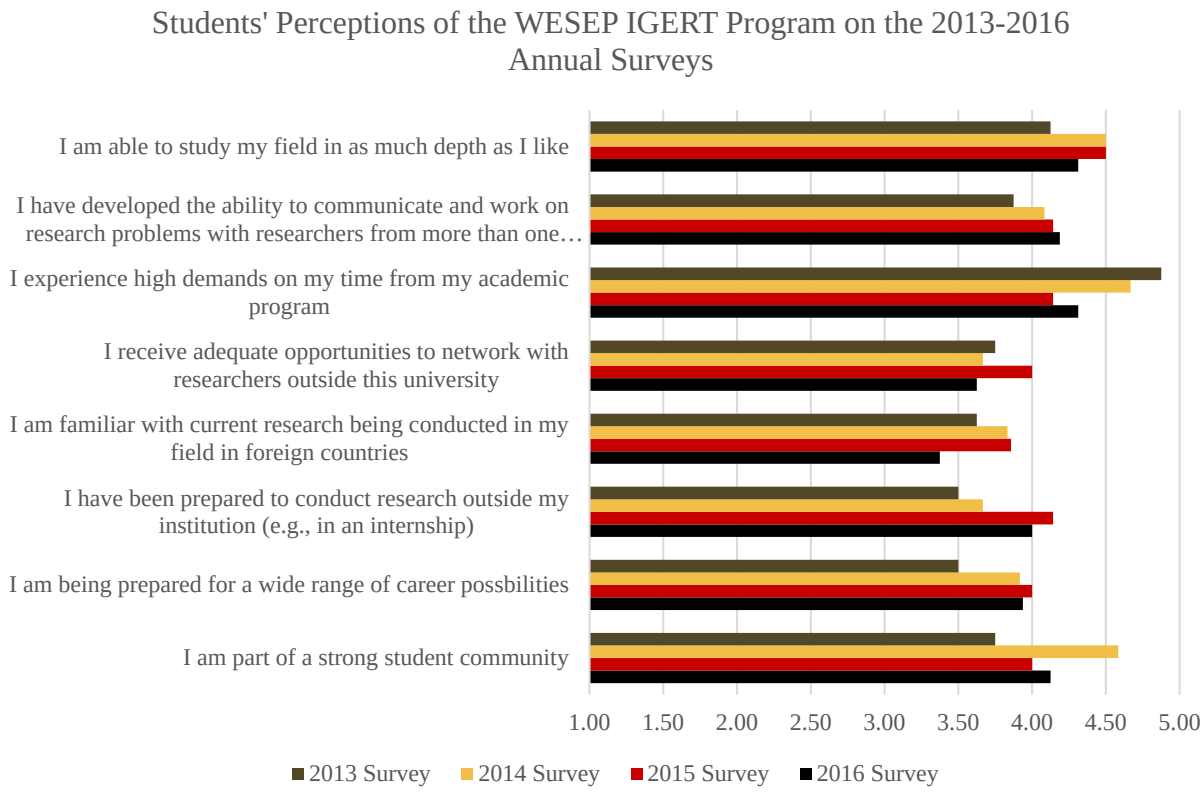

Figure 10. Students' perceptions of the WESEP IGERT program in the 2013-2016 annual surveys. (2013 n = 8, 2014 n = 12, 2015 n = 14, 2016 n = 6). For consistency, incoming students into the program were included in this chart (In the 2013 annual survey, incoming students were not asked to respond to this question. In the 2014, 2015, and 2016 surveys, incoming students responded to this question but their responses are not included here.). Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree.

Students were asked about the types of careers they would prefer, as well as the extent to which they felt prepared to go into various types of careers (Table 11). Students across cohorts were least interested in careers in academia, and more interested in careers involving research or in industry. Most students also indicated that they felt more prepared for a career in research or industry than they did for a career in academia. This question was new on the 2015 annual survey, and was not posed on the 2013 or 2014 annual surveys; thus, annual results are not presented.

Table 11: Students' Career Plans and Perceptions of Preparedness

	2012 Cohort			2013 Cohort			2014 Cohort			2015 Cohort			2016 Cohort		
	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.	n	Mean	s.d.
I would prefer a career in academia.	2	3.00	2.83	6	2.33	1.033	3	2.33	0.577	3	2.67	0.577	4	2.25	0.957
I will be well-prepared for a career in academia.	2	2.00	1.41	6	3.00	1.265	3	4.00	0.000	3	3.67	1.155	4	3.25	0.500
I would prefer an career in industry	2	4.00	1.41	6	3.83	0.408	3	4.33	0.577	3	4.00	0.000	4	4.00	1.155
I will be well-prepared for a career in industry.	2	5.00	0.00	6	3.83	0.753	3	4.00	0.000	2	4.00	1.414	4	3.75	0.957
I would prefer a career in government, non-profit agencies, or NGOs.	2	2.50	0.71	6	3.33	1.366	3	4.00	1.000	3	4.33	0.577	4	3.50	1.291
I will be well-prepared for a career in government, non-profit agencies, or NGOs.	2	3.00	0.00	6	3.67	0.516	3	4.00	0.000	3	3.67	0.577	4	3.75	0.957
I would prefer a career that involves doing research.	2	4.00	0.00	6	4.33	0.816	3	4.33	1.155	3	3.67	0.577	4	3.75	1.258
I will be well-prepared for a career that involves doing research.	2	4.50	0.71	6	4.33	0.516	3	4.67	0.577	3	3.67	0.577	4	3.75	0.957

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

What suggestions do you have to improve the IGERT program?

- A few more opportunities to speak in more one-on-one sessions with some of the invited speakers to the 594 presentations would be nice. The fact that we get to listen to them and hear their research in a presentation is definitely enlightening and it nearly always ignites some ideas for research. Having the opportunity to eat lunch with them in a smaller setting would lead to some extended discussions and a more personable take on their research.
- I am in my first week, so I haven't had much experience with the program. One aspect that has been slightly difficult is that its interdisciplinary nature makes it tough to get paperwork in to the proper office or to know where to go to for information about certain aspects of the program.
- I wish we could have had a stronger focus on policy issues in wind energy.
- It would be great if we could invite more people from the policy side to educate us about the future trend for wind energy in the U.S. or outside of U.S.
- It would be nice to get a secretary back, someone who can answer questions about the bureaucratic things, like administrative issues, funding, supplies, etc.
- More industry involvement if possible, see above question.
- Reorganize WESEP 594 and actually listen to student suggestions.
- Streamline the process for exceptions to the primary WESEP curriculum. Perhaps review exceptions to the curriculum the week before each semester starts (Twice a year). Sometimes we're told a class should count towards our degree even if it isn't on the list of required courses but getting written notification of an exception can take a long time.

Please use this space to discuss any other comments or concerns you may have.

- Expectations and requirements are not well communicated between WESEP coordinates and WESEP professors. Communication between professors and between professors and students does not always happen or does not always happen well.
- I have not been in the IGERT program long enough to be able to provide much feedback yet. I'm excited to see where the program takes me, though.
- No other concerns at this time.
- Some of my answers may not be relevant since it is only my first week of the program. Overall I am very excited to be part of such a great program that fits my specific interests so well. This program is helping me pursue exactly what I want to pursue as a graduate student.

The seven students who indicated that they planned to graduate with in a year were asked three additional open-ended questions, which are listed below.

What are your plans after graduation from the program? (e.g., Have you started looking into career opportunities? Do you plan to go into academia or industry? Etc.)

- Find a job. I have not started actively looking but I have made connections in industry and government research facilities.

- I am currently exploring industry career opportunities.
- I have started looking for opportunities mostly in industry; however, I have not heard back from any of the applications yet. Academia would be my last choice.
- I have started looking into career opportunities by way of an internship in industry that could lead to full-time employment post-graduation.
- I plan to go to industry side and still want to be involved in the wind energy research area.
- Still looking for jobs in industry or national labs.

What do you view to be the highlight of your experience in the WESEP IGERT program?

- My international experience was the highlight, as it provided an opportunity to interface directly with researchers doing relevant work in the area of my research.
- Learning the many disciplines that go into large engineering projects like wind farms.
- The international experiences. I spent last summer working in Switzerland with a well-known researcher in my field. The summer before, I was able to attend conferences in Denmark and Germany.
- It helps me have an interdisciplinary view of wind energy and wind engineering, but also improves communication skills to research experts and public audience.
- The amount of problem solving skills I have learned working in the Wind Simulation and Testing Lab.
- The highlight would be designing, building, and constructing a full-scale section of a wind tower at MAST laboratory in Minnesota.

Were there experiences in the WESEP IGERT program that you felt were lacking or not very useful? Please explain.

- I would have liked to see more collaboration with industry. My project involved industry collaboration but many of my peers' research did not. I believe industry involvement will be a key component to continuing the WESEP program and providing jobs for graduates.
- No.
- Over the past two years, WESEP 594 has changed significantly and I do not like where it is heading. Student presentations are frowned upon unless you have recently completed an international experience (and only one that has been paid for by the program). I understand that industry presentations and those from faculty at other universities are useful, but many of the opportunities we originally had in this seminar are gone or our requests for them are ignored. Also, there are a lot of live webinars in this seminar, which gets boring and students do not have the opportunity to network with potential employers or Post-doc PIs. I honestly do not like going to this seminar once a week.

2.2 Annual Faculty Survey

This section of the report details faculty members' responses to the annual faculty survey and is broken down into three subsections: 2.2.1) Research, Publications, and Other Scholarly Activity; 2.2.2) Impact of IGERT on Graduate Students; and 2.2.3) Impact of

Participating in IGERT and Suggestions for Program Improvement. Each of these subsections is comprised of similar questions. All 25 of the WESEP IGERT-affiliated faculty members at Iowa State University were sent an e-mail in August 2016 inviting them to complete the faculty survey. Of these 25 faculty members, eight responded to the survey. Not all faculty members responded to every question. It is of note that the 25 faculty members derive from 10 departments and three colleges.

Overview

Faculty participation in the IGERT program is presented in Table 12. Nearly 90% of the faculty reported that they advised IGERT graduate students and nearly 90% indicated that they conducted IGERT-related research. Sixty-three percent reported teaching IGERT courses, and 50% reported that IGERT graduate students worked in their labs. Twenty-five percent contributed to IGERT project management. Thirty-eight percent served on IGERT dissertation committees, 38% attended IGERT workshops or lectures, and 38% participated in "other" meaningful ways.

Table 12: Participation in the IGERT Project

	n	%
I advise IGERT graduate students	7	87.5
I serve on IGERT dissertation committees	3	37.5
I conduct IGERT-related research	7	87.5
I attend IGERT workshops or lectures	3	37.5
IGERT graduate students work in my lab	4	50.0
I teach IGERT courses	5	62.5
I contribute to IGERT project management	2	25.0
Other[a]	3	37.5

Research, Publications and Other Scholarly Activity

This section provides an overview of four closed-ended questions related to faculty research and publication and other scholarly activity. Faculty members were asked about the numbers of publications which they had authored, coauthored, and/or participated in interdisciplinary research on. They were also asked about interdisciplinary research publications and other scholarly activity.

Faculty responses regarding their research output in WESEP over the past year are displayed in Table 13. On peer-reviewed journal articles related to WESEP, faculty reportedly served as a primary author two times, a co-author nine times, and worked with an interdisciplinary author/co-author six times. On conference presentations or posters related to WESEP, faculty reportedly served as primary author three times, co-author 10

times, and worked with an interdisciplinary author/co-author eight times. One faculty member reported serving as a primary author on a book chapter. Faculty reported serving as the primary author on grant proposals five times.

As shown in Figure 11, faculty notably decreased in their reported numbers of journal articles, conference presentations, patent applications or approved patents, and grant proposals. However, the low response rate from faculty to the survey means that fewer publications were likely to be reported.

Table 13: Faculty, Publications and Other Scholarly Activity Related to WESEP

	n	Mean	s.d.
Journal articles in refereed journals			
Primary Author	2	0.25	0.463
Co-author	9	1.13	1.126
Interdisciplinary author/co-authors	6	0.75	1.035
Conference paper or poster presentations			
Primary Author	3	0.38	0.744
Co-author	10	1.25	1.389
Interdisciplinary author/co-authors	8	1.00	1.195
Book chapters			
Primary Author	1	0.13	0.354
Co-author	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-
Books			
Primary Author	0	0.00	-
Co-author	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-
Patent applications			
Primary Author	0	0.00	-
Co-author	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-
Approved patents			
Primary Author	0	0.00	-
Co-author	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-
Grant proposals			
Primary Author	5	0.63	1.188
Co-author	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-
All other publications			
Primary Author	0	0.00	-
Co-author	0	0.00	-
Interdisciplinary author/co-authors	0	0.00	-

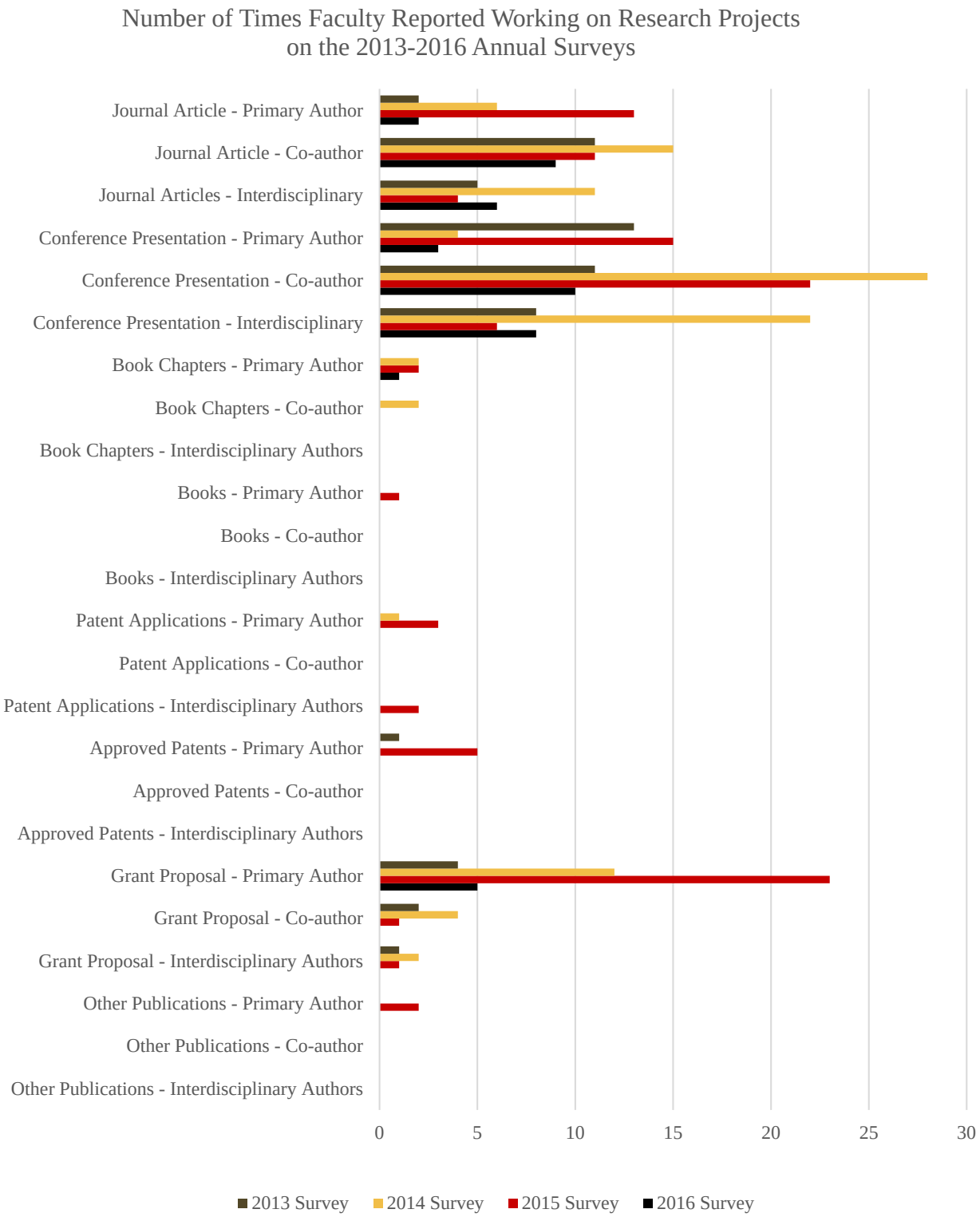

Figure 11. Number of times faculty reported working on research projects in 2013-2016 annual surveys. (2013 n = 17, 2014 n = 18, 2015 n = 15, 2016 n = 8).

As shown in Table 14, faculty were asked to indicate whether they had published research findings in a journal, or presented research findings at a conference, outside their home discipline within the last year. Three of the eight faculty respondents indicated that they had presented research findings at a conference outside their home discipline, and four faculty members reported that they had published research findings in a journal outside their home discipline.

The percentage of faculty reporting that they had published research findings in a journal outside their home discipline or presented research findings at a conference outside their home discipline within the last year remained fairly stable on the 2013-2016 surveys (Figure 12). However, a smaller percentage of faculty members reported presenting research findings at a conference outside of their home discipline in 2016.

Table 14: Research Publications and Professional Conference Talks/Posters Outside of the Faculty Home Discipline

	n	%
Published research findings in a journal outside your home discipline.	4	50.0
Presented research findings at a conference outside your home discipline.	3	37.5

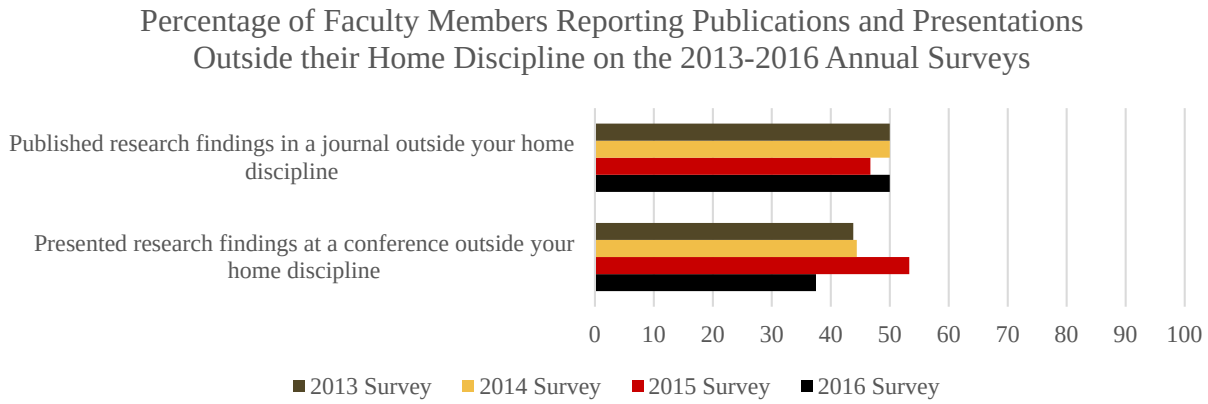

Figure 12. Percentage of faculty members reporting publications and presentations outside their home discipline on the 2013-2016 annual surveys (2013 n = 16, 2014 n = 18, 2015 n = 15, 2016 n =8).

Impact of IGERT on Graduate Students

Faculty members were asked to respond to an open-ended question about departmental recruiting of graduate students and three closed-ended questions related to the impact of IGERT on graduate admissions, the preparation of graduate students, and the usefulness of the WESEP 594: the RTRC.

What strategies were used to attract a highly qualified, diverse pool of applicants for the IGERT program?

Three faculty members responded to this question. Faculty mentioned stipends and fellowship opportunities; advertising the interdisciplinary and diverse environment; and advertising via email, letters to strategic departments, distributing fliers, and word of mouth. Faculty responses are listed below.

- Increased stipend provided to students help attract better students.
- Opportunity to affiliate with interdisciplinary (primarily engineering) students, well-paying fellowship, welcoming diverse environment.
- Advertised by emails to list serves, by letters to various departments, by distributing flyers at conferences, by distributing flyers around ISU campus, by word of mouth to faculty colleagues at other universities.

WESEP faculty members were asked to respond to a series of questions on the impact of IGERT on their home department admissions, as shown in Table 15. Faculty agreed most strongly that they have attracted more students who are U.S. citizens and more students who have inter/multidisciplinary backgrounds. Faculty reported low levels of agreement, however, with the items *we have experienced increased admissions inquiries into our program, we have attracted more underrepresented minority students, we have attracted more international students,* and *we have attracted students from a collectively more varied disciplinary background.*

As shown in Figure 13, faculty members agreed less on all but one item related to the impact of IGERT on departmental missions on the 2016 annual survey than they did on the 2015 annual survey. Faculty agreed that they have attracted more female students.

Table 15: Impact of IGERT on Departmental Admissions

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	n	Mean	s.d.
We have attracted better qualified students	0	2	4	2	0	8	3.00	0.756
We have attracted more students	0	2	4	2	0	8	3.00	0.756
We have attracted more students who are U.S. citizens	0	2	3	2	1	8	3.25	1.035
We have attracted students who have inter/multidisciplinary backgrounds	0	2	3	2	1	8	3.25	1.035
We have experienced increased admissions inquiries into our program	0	3	5	0	0	8	2.63	0.518
We have attracted students from a collectively more varied disciplinary background	0	3	3	2	0	8	2.88	0.835
We have attracted students with different career goals	1	0	5	2	0	8	3.00	0.926
We have attracted more underrepresented minority students	1	2	4	1	0	8	2.63	0.916
We have attracted more female students	1	1	2	4	0	8	3.13	1.126
We have attracted more international students	1	2	5	0	0	8	2.50	0.756

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

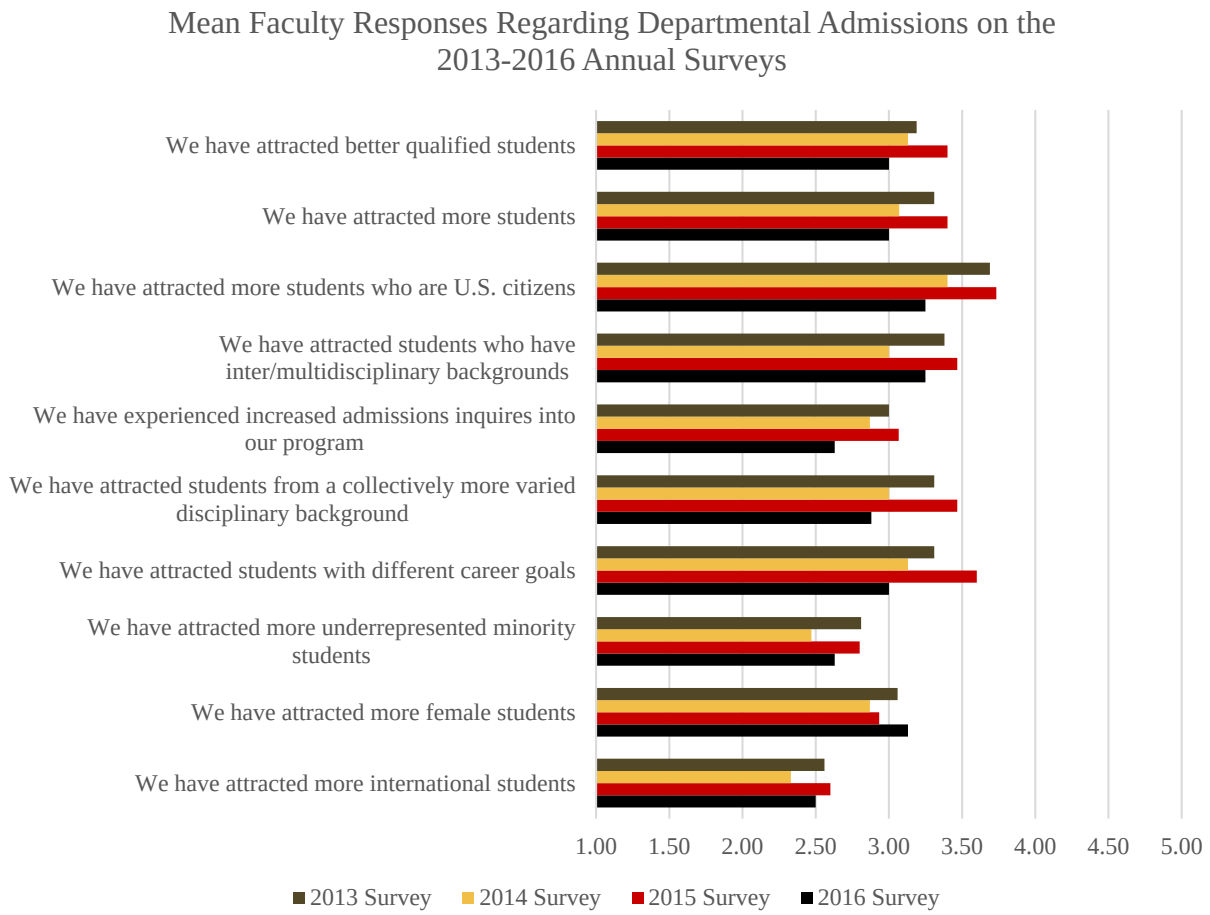

Figure 13. Mean faculty responses regarding departmental admissions on the 2013-2016 annual surveys (2013 n = 16, 2014 n = 15, 2015 n = 15, 2016 n = 8). Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree.

IGERT faculty members were asked to compare IGERT and Non-IGERT graduate students in their respective home departments, as detailed in the responses in Table 16. Notably, the IGERT students were rated as being better prepared than their Non-IGERT peers on all but one item, on which they were rated equally. IGERT students were rated the highest in their present research findings to scientific items. The disparity between the ratings received by IGERT and Non-IGERT students was over a full scale point on items related to preparedness to communicate with people outside of their field, work in teams of researchers from more than one discipline, work outside of academia, and communicate research findings to the general public.

As shown in Figure 14, faculty tended to rate IGERT students higher than Non-IGERT students on the 2013 – 2016 surveys. Faculty did tend to rate IGERT students as slightly more prepared on the 2016 survey than they did on the 2015 survey in certain areas, such as presenting research findings to scientific peers, collaborating with international scientists, and communicating research findings to the general public, though overall responses were similar from the 2013 – 2016 survey.

Table 16: Preparation of Graduate Students

	Not prepared	A little prepared	Somewhat prepared	Mostly prepared	Very prepared	Not sure/ not applicable	n	Mean	s.d.
Conduct high-quality research									
IGERT Graduate Students	0	0	1	2	5	0	8	4.50	0.756
Non-IGERT Graduate Students	0	0	2	4	2	0	8	4.00	0.756
Present research findings to scientific peers									
IGERT Graduate Students	0	0	1	0	7	0	8	4.75	0.707
Non-IGERT Graduate Students	0	0	2	5	1	0	8	3.88	0.641
Know their own discipline in depth									
IGERT Graduate Students	0	0	2	2	4	0	8	4.25	0.886
Non-IGERT Graduate Students	0	0	1	4	3	0	8	4.25	0.707
Communicate with people inside their field									
IGERT Graduate Students	0	0	1	2	5	0	8	4.50	0.756
Non-IGERT Graduate Students	0	0	2	4	2	0	8	4.00	0.756
Work in research teams within their discipline									
IGERT Graduate Students	0	0	1	2	5	0	8	4.50	0.756
Non-IGERT Graduate Students	0	0	3	3	2	0	8	3.88	0.835
Understand and work in an academic setting									
IGERT Graduate Students	0	0	1	4	3	0	8	4.25	0.707
Non-IGERT Graduate Students	0	0	2	5	1	0	8	3.88	0.641
Write research articles or books									
IGERT Graduate Students	0	0	1	1	6	0	8	4.63	0.744
Non-IGERT Graduate Students	0	0	3	4	1	0	8	3.75	0.707
Conduct research in an ethical manner									
IGERT Graduate Students	0	0	1	1	6	0	8	4.63	0.744
Non-IGERT Graduate Students	0	1	1	4	2	0	8	3.88	0.991
Communicate with people outside their field									
IGERT Graduate Students	0	0	1	3	4	0	8	4.38	0.744
Non-IGERT Graduate Students	1	1	3	3	0	0	8	3.00	1.069

Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared
Not Sure/Not Applicable responses are not included in the calculation of the n, mean, or standard deviation.

Table 16: Preparation of Graduate Students (con't)

	Not prepared	A little prepared	Somewhat prepared	Mostly prepared	Very prepared	Not sure/ not applicable	n	Mean	s.d.
Work in teams of researchers from more than one discipline									
IGERT Graduate Students	0	0	1	5	2	0	8	4.13	0.641
Non-IGERT Graduate Students	0	3	3	2	0	0	8	2.88	0.835
Work outside of academia, (industry, public sector)									
IGERT Graduate Students	0	0	3	1	4	0	8	4.13	0.991
Non-IGERT Graduate Students	0	3	3	2	0	0	8	2.88	0.835
Collaborate with international scientists									
IGERT Graduate Students	0	0	2	2	4	0	8	4.25	0.886
Non-IGERT Graduate Students	0	0	5	3	0	0	8	3.38	0.518
Communicate research findings to the general public									
IGERT Graduate Students	0	0	1	3	4	0	8	4.38	0.744
Non-IGERT Graduate Students	0	1	4	3	0	0	8	3.25	0.707

Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared
Not Sure/Not Applicable responses are not included in the calculation of the n, mean, or standard deviation.

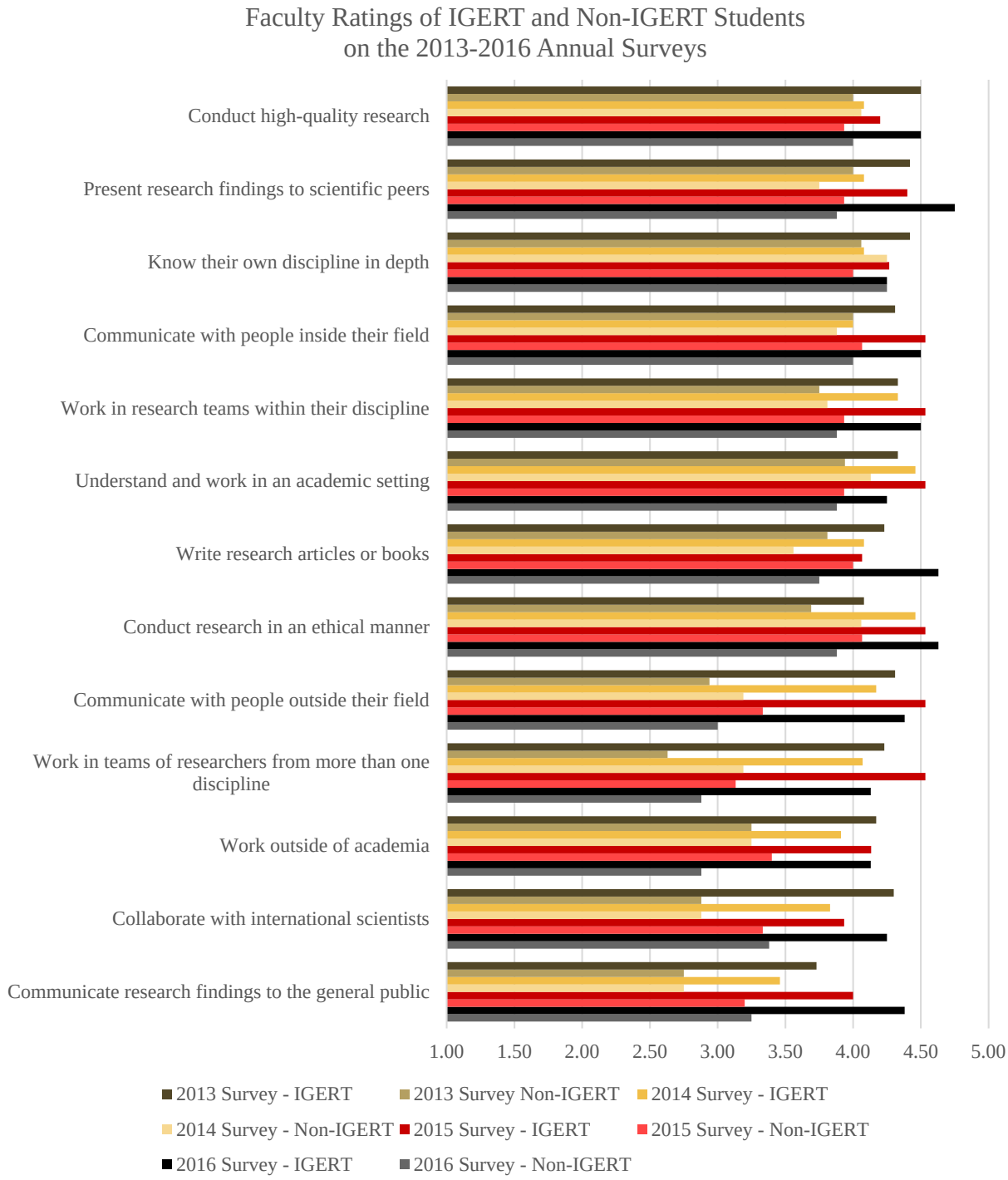

Figure 14. Faculty ratings of IGERT and Non-IGERT students on the 2013-2016 annual surveys (2013 IGERT n = 12, 2013 Non-IGERT n = 16, 2014 IGERT n = 13, 2014 Non-IGERT n = 16, 2015 IGERT n = 15, 2015 Non-IGERT n = 15, 2016 IGERT n = 8, 2016 Non-IGERT n = 8). Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared.

Faculty members were asked a series of questions about WESEP 594: The RTRC. Their responses are given in Table 17. All responding faculty agreed that the RTRC was very useful on all but one item; one faculty member reported that the RTRC was somewhat

useful in teaching students how to do research. Notably, however, most faculty members were unsure about the usefulness of the RTRC in each area.

As shown in Figure 15, responding faculty rated WESEP 594: The Real Time Research Collaborative higher overall on the 2016 survey than they had in previous years.

Table 17: Usefulness of WESEP 594: The Real Time Research Collaborative

	Not at all useful	A little useful	Somewhat useful	Very useful	Not sure/ not applicable	n	Mean	s.d.
Teaching students how to do research	0	0	1	2	5	8	3.67	0.577
Stimulating and enhancing students' research productivity	0	0	0	3	5	8	4.00	0.000
Facilitating students' interdisciplinary work	0	0	0	3	5	8	4.00	0.000
Enhancing students' communication skills	0	0	0	3	5	8	4.00	0.000
Enhancing students' awareness of and ability to respond to ethical issues	0	0	0	3	5	8	4.00	0.000
Learning about environmental and policy issues	0	0	0	3	5	8	4.00	0.000
Making industry connections	0	0	0	3	5	8	4.00	0.000

Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful
Not Sure/Not Applicable responses are not included in the calculation of the n, mean, or standard deviation.

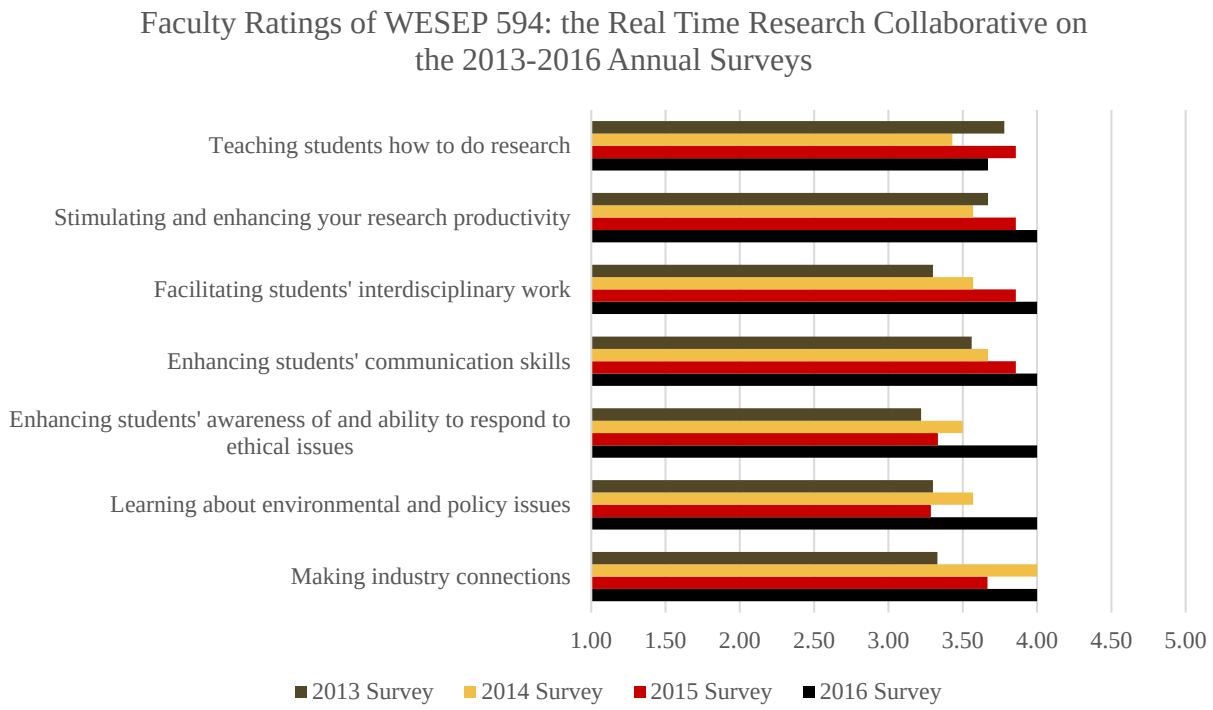

Figure 15. Faculty ratings of WESEP 594: The Real Time Research Collaborative on the 2013 - 2016 annual surveys (2013 n = 9, 2014 n = 7, 2015 n = 7, 2016 n = 3). Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful.

Impact of Participating in IGERT and Suggestions for Program Improvement

Faculty members were asked to respond to three closed-ended questions related to the impact of participating in the IGERT program, including the amount of time they spent on activities in their home department, the impact of IGERT on their professional lives, and the impact of IGERT on their home departments. They were also asked for suggestions on how to improve the IGERT program.

Faculty responses to the question of how involvement in IGERT has affected their time spent in their home departments are summarized in Table 18. Six faculty members said they spent equal time teaching department courses, while two spent less time. Seven spent equal time advising departmental students, while one faculty member spent less time doing this. All eight indicated the spent the same amount of time engaging in department leadership activities. Six faculty members indicated that they spent the same amount of time conducting research with other departmental faculty, while two reportedly spent less time doing this.

Results from the question about how IGERT has affected faculty members' time spent in their home departments from the 2013-2015 surveys are not pictured. However, results from the 2013-2015 surveys were similar, with most faculty members suggesting that they spent an equal amount of time in their home department on each activity.

Table 18: Time Spent in Home Department

	Less time		Equal time		More time	
	n	%	n	%	n	%
Teaching department courses	2	25.0	6	75.0	0	0.0
Advising department students	1	12.5	7	87.5	0	0.0
Engaging in department leadership activities	0	0.0	8	100.0	0	0.0
Conducting research with other departmental faculty	2	25.0	6	75.0	0	0.0

Faculty were asked to indicate how IGERT influenced their professional lives (Table 19). On average, faculty agreed most strongly that they had been exposed to new ideas outside of their area of knowledge, with seven faculty agreeing to this item and no faculty disagreeing. Faculty also agreed strongly, on average, that they met faculty in other departments who they would not otherwise have met and that they were more likely to conduct research with colleagues in disciplines outside of their own. Faculty were least likely to agree that they had less time to conduct their own research, with no faculty members agreeing to this item. Figure 16 displays the comparison of faculty members' responses regarding the impact of IGERT on their professional lives on the 2013-2016 annual surveys. Faculty have maintained rated strong or weak levels of agreement on many of the same items throughout the years of the annual survey, though in 2016 faculty agreed substantially less that they could explore research topics that would otherwise not be funded, that they have learned new research techniques, and that they would be more likely to consider team-teaching with a faculty member outside their department. Faculty reported more agreement with four items, including that they had been exposed to new ideas outside their area of expertise.

Table 19: Impact of IGERT on Professional Life

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree	n	Mean	s.d.
I have been exposed to new ideas outside my area of knowledge.	0	0	1	5	2	8	4.13	0.641
I have met faculty in other departments whom I would not otherwise have met.	0	0	3	4	1	8	3.75	0.707
I am able to work with a greater variety of students.	0	2	1	4	1	8	3.50	1.069
I am more likely to conduct research with colleagues in disciplines outside my own.	0	0	2	5	1	8	3.88	0.641
My teaching has become more interdisciplinary.	1	2	1	3	1	8	3.13	1.356
I am more likely to consider team-teaching with a faculty member outside my department.	0	3	2	3	0	8	3.00	0.926
I am in a better position to obtain new research grants.	0	1	4	3	0	8	3.25	0.707
I have learned new research techniques.	0	4	2	2	0	8	2.75	0.886
I can explore research topics that would not otherwise be funded.	0	3	3	1	1	8	3.00	1.069
I am able to work with students who are better qualified than Non-IGERT students in my department.	0	1	5	2	0	8	3.13	0.641
I have less time to conduct my own research.	0	3	5	0	0	8	2.63	0.518

Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree

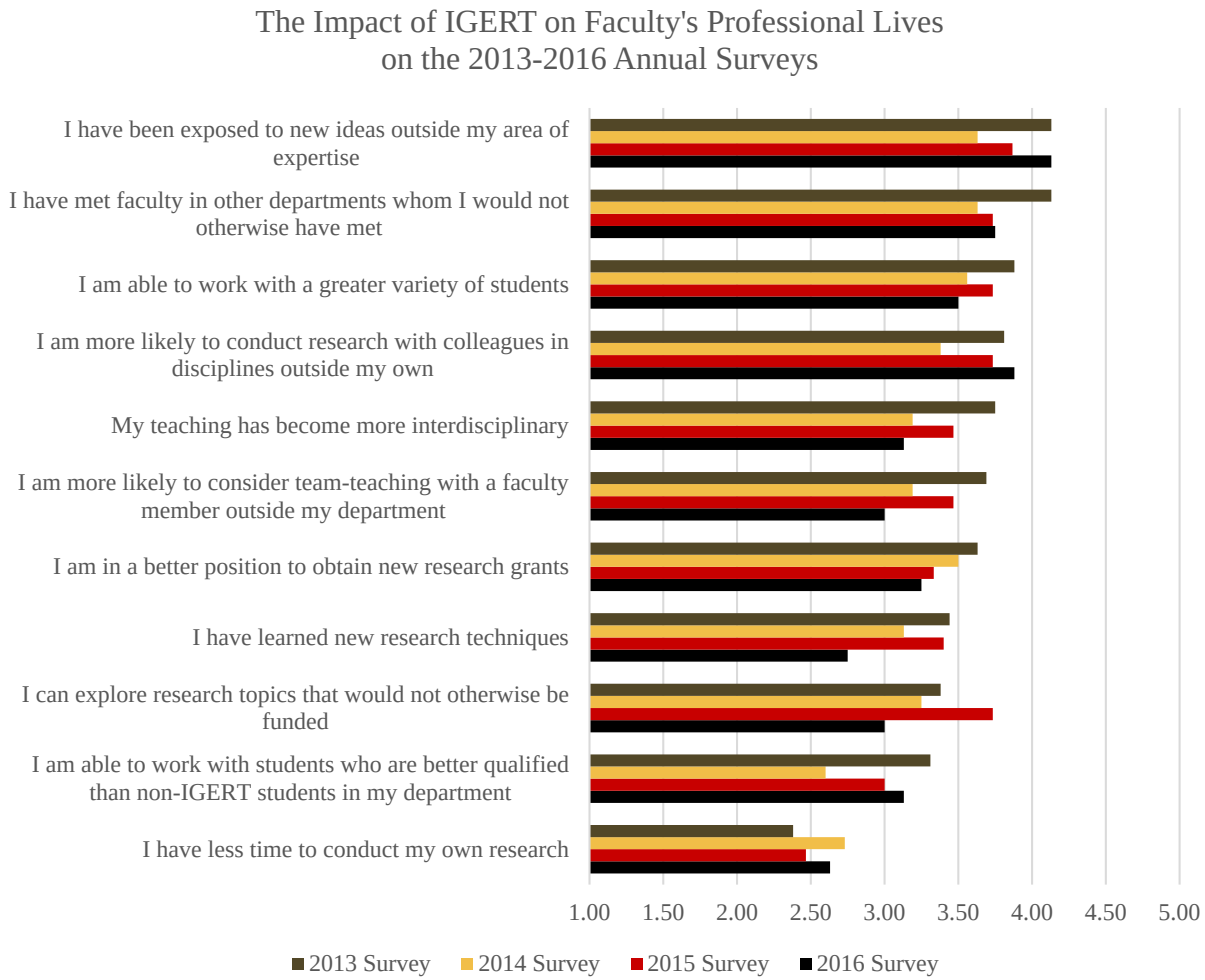

Figure 16. The impact of IGERT on faculty's professional lives on the 2013-2016 annual surveys (2013 n = 16, 2014 n = 16, 2015 n = 15, 2016 n = 8). Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree.

The impacts of the IGERT program on faculty members' home departments are summarized in Table 20. All eight of the responding faculty believed that the program altered the research scope of faculty involved in the program and improved faculty mentoring of students. Seven faculty reported that the IGERT program improved the quality of faculty research in their home department, though one faculty member indicated that the program did not have this effect.

Survey responses from the 2013-2016 annual surveys regarding the impact of IGERT on faculty members' home departments are displayed in Figure 17. Faculty members' responses were consistent in indicating a moderate impact in each area. Faculty reported an increased impact of the IGERT program in all three areas on the 2016 survey compared to the 2015 survey.

Table 20: Impact of IGERT on Faculty's Home Department

	Not at all - 1	2	3	4	Extensively - 5	n	Mean	s.d.
Improved the quality of faculty research	1	0	4	3	0	8	3.13	0.991
Altered the research scope of involved faculty	0	0	3	5	0	8	3.63	0.518
Improved faculty mentoring of students	0	2	3	3	0	8	3.13	0.835

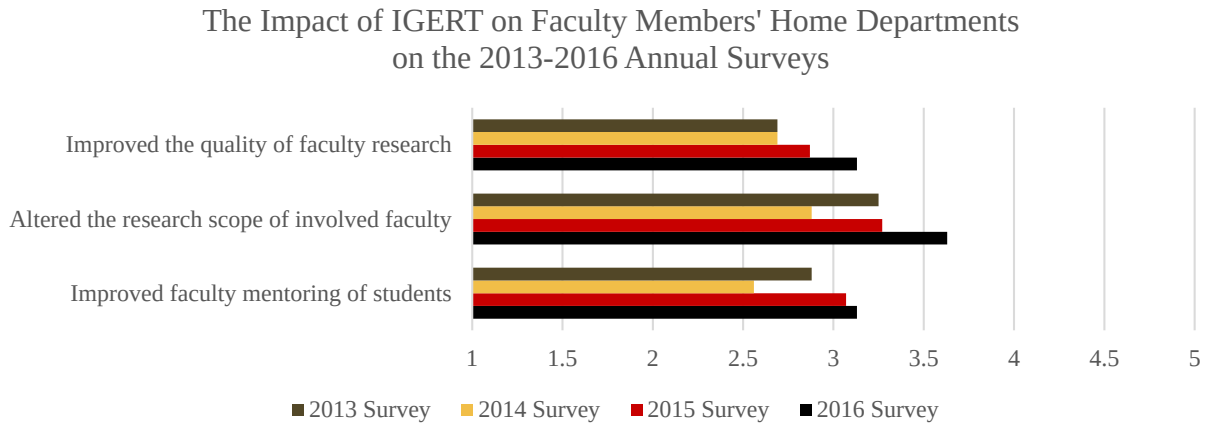

Figure 17. The impact of IGERT on faculty members' home departments on the 2013-2016 annual surveys (2013 n = 16, 2014 n = 16, 2015 n = 15; 2016 n = 8). Scale: 1 = Not at all, 5 = Extensively.

What suggestions do you have to improve the IGERT program?

One faculty reported the need to expand student recruitment, and another mentioned the need to secure more funding to continue the program beyond the NSF grant period. Faculty responses are listed below as they were provided.

- Recruiting activities could be expanded to attract more candidates for the program
- Need funding to continue program following expiration of IGERT.

Please use this space to discuss any other comments or concerns you may have.

One faculty member responded with an additional comment, which is listed below as it was provided.

- The program benefits from excellent leadership.

Student Focus Groups and Interviews

The evaluation team, led by Len Pietrafesa, with support from Brandi Geisinger and Mari Kemis, conducted WESEP IGERT student interviews in two formats. The first format was a focus group in which all current students and several recent PhD graduates of the WESEP IGERT program were invited to participate. The second format consisted of individual

interviews, which were conducted with 11 of the WESEP IGERT students and three WESEP IGERT graduates. Extensive notes were taken during and immediately after the interviews and focus group. A total of 17 students participated in the on-campus interviews and/or focus group. The analysis of the student focus group and individual interviews below was conducted on the extensive notes from individual student interviews and the focus group. Due to the fact that the focus group and interview topics and conversations tended to be similar, results of the focus group and interview conversations are presented together and not distinguished.

In the focus group and individual interviews, students discussed a variety of topics, noting things that they particularly liked about the program and suggestions for program improvement. The topic areas discussed included: coursework, qualifying exams, interdisciplinary program, Wind Energy Student Organization, student resources, student recruitment, industry connections and employment, research and publications, career opportunities and program preparation, and the WESEP IGERT program sustainability. Overall, students were pleased with their experiences in the WESEP IGERT program.

Coursework - Updates

WESEP 594: The Real-Time Research Collaborative

Overall, students indicated the Fall 2016 594 was a useful experience and found the changes made in the past few years to be very helpful. Students felt the seminar was a good way to learn about current interdisciplinary topics and stay connected to other students in the program. Students specifically mentioned that the communication-related and policy-related presentations were especially useful. Students suggested that the seminars might be enhanced by allowing students some time to interact and network with industry presenters after presentations. Students had previously expressed remaining concerns regarding the ways in which WESEP 594 has been assigned credit and appears on their transcripts. This problem has been corrected according to the office of the Graduate School Dean and as such the transcripts of the students who have taken 594 have received credit retroactively. This past situation has been corrected and rectified and all WESEP students have received one credit for each time that they had taken 594. This will correct the students' POSs and also rectify the false impressions left in the students' transcripts by prior repeats of the same course with no accumulating credit hours, as they need to reach a total of 72 credit hours for their PhD.

WESEP 501 and 502

Students reported that WESEP 501 and 502 were good introductory courses with a lot of breadth. In WESEP 501, students appreciated having advanced students in the program do some of the teaching, and the advanced students indicated they appreciated the opportunity to do some of the teaching. Students in the course reported that the advanced students were

skilled at explaining concepts in ways that they understood. Students in the course did mention that it could be difficult to adapt to multiple teaching styles within the same course, and some students noted that it could feel unstructured. Students reported that they were not sure when or if WESEP 502 would be offered in Spring 2017, and noted that it would be useful to have courses arranged earlier for scheduling purposes.

WESEP 512

Students reported that WESEP 512 was a useful course, and one reported that it was, "one of the best classes in my graduate program." Students noted that it provided opportunities to improve communication and learn how to write research proposals. Students wished that it had been offered more frequently.

Qualifying Exams

Two students indicated they had received inconsistent information about the requirements for their qualifying exams, and reported that they were not informed that they needed to have research results for their qualifying exams until shortly before the exam date. WESEP leadership is aware of this situation and meeting with the advisors of the two affected students to insure that the students' interests, as well as the Program integrity, are both protected. The documented requirements may need to be clarified and discussed among program faculty to prevent future confusion.

Interdisciplinary Program

Students appreciated the interdisciplinary nature of the WESEP IGERT program and indicated that it was a major factor in their decision to join. They reported that the weekly seminars were a good way to keep them up to date on current interdisciplinary research, but also indicated that in some ways, the program was not as interdisciplinary as they had hoped that it would be. Students indicated that faculty tend to be focused in discipline-specific research and are not necessarily thinking in interdisciplinary manners or open to more interdisciplinary topics. One student, however, noted that although the program did not incorporate as many disciplines as she had originally anticipated, the PI had been very willing to adjust the curriculum as needed to meet her needs and expand to new areas.

Students were disappointed that "policy" aspects of WESEP were not more integrated into the program and several students reported that they wished they had been better able to explore policy issues in their coursework, research, and theses. One student reported that he wanted to take more policy courses, and remarked "I could never convince my advisor that it was worth my time."

Wind Energy Student Organization

The Wind Energy Student Organization (WESO) has been very active both on and off campus. WESO has been quite successful in engaging ISU undergraduate students in wind energy research. WESEP IGERT fellows noted that WESO meetings were well-attended, and that the WESO organization had been very active in promoting wind energy throughout the Ames community and especially at engaged Ames K-12 schools.

Student Resources

Several students noted that the program's current lack of an administrative assistant could make things more challenging, and new students, in particular, reported that it was difficult to navigate the process of entering the department without an administrative support person. Students overall, however, noted that the program PI was a useful resource and was generally very willing to help students.

Student Recruitment

Students noted that recruiting new students to the WESEP IGERT program had always been difficult, and one noted that, "more students would make it a more impressive program." A couple of students wondered if broadening the focus of the program might help to attract more students.

Industry Connections and Employment

Students believed that the WESEP IGERT program could be improved by increasing the number of opportunities available for engagement with industry, and creating stronger ties to industry. Most students reported a desire to pursue a career in industry after graduation, and students viewed industry connections as valuable resources for future employment prospects. Students noted that adding time in WESEP 594 to network with the industry speakers would be an easy way to meet this need. Students also noted that most students had not pursued industry internships in the United States as part of their WESEP IGERT experience. Students did mention that the U.S. DOE Ames Lab, co-located on the ISU Campus, was a good recent connection, and that the program had not been well connected to the Ames Lab until this year. It must be noted that the U.S. DOE has had a recent national policy of "pulling its' research inside of the Lab" and thus the WESEP related faculty and the WESEP IGERT fellows have been relatively disadvantaged in becoming more engaged with Ames Lab R&D activities. Albeit, the more advanced IGERT fellow-students noted that they had witnessed the number of wind energy industry ties having increased during their time in the WESEP program.

Research and Publications

Several students indicated that they were working on large research projects, and many were pleased that they were able to conduct interdisciplinary research within the program. Students' research topics were varied, ranging from new tower structure designs, to

computing issues, noise quieting features, and so on. Many students reported giving professional conference presentations, both oral and poster, working toward peer-reviewed publications on their research, and publishing in the peer reviewed literature.

Career Opportunities and Program Preparation

A number of students discussed the career opportunities that might be available after they graduate from the program. Students noted that the program prepared them to go into a range of areas, and although students were concerned about the future of wind energy funding given the current political climate in the country, they felt that they would have options available to them. Advanced students were considering careers in faculty positions, national laboratories, and industry. Students reported that their experiences working in the wind energy systems lab and wind tunnel prepared them well for careers in the field, though several students noted that wind energy researchers outside of Iowa State University could be reluctant to accept new and interdisciplinary ideas.

Students were largely satisfied with the interdisciplinary training they received in the IGERT program. They also indicated that they had received excellent training in communicating in front of an audience, and reported that they were better able to communicate, particularly with diverse audiences, than other students in their home disciplines.

WESEP IGERT Program Sustainability

Many students discussed the sustainability of the WESEP IGERT program and what the program might look like in the future.

Faculty Interviews

Individual interviews were completed with eight ISU faculty members. One additional interview was conducted with the Wind Energy Systems Lab Manager. Extensive notes were taken during and immediately after the interviews, and the analysis of the faculty interviews is based on these notes.

Faculty discussed a variety of topics, noting things that they particularly liked about the program and also made suggestions for program improvement. Overall, faculty expressed a high level of support for the WESEP IGERT program, and deemed it a valuable asset to the university and the field. They offered that the IGERT student fellows were of exceptional quality, and felt the program was very well-managed by the IGERT PI. Faculty responses regarding things that they liked about the program and suggestions for program improvement are discussed in more detail below.

Program Positives

Faculty members reported that the WESEP IGERT program was a strong program with good cultures of collegiality among both faculty and students. It is of note that as of 2016, there are 25 faculty members from 10 departments in three colleges engaged in WESEP IGERT; suggesting a strong interdisciplinary program.

Faculty members noted that the WESEP IGERT program was valuable to students and that their students had more holistic opportunities and reported that their students were receiving broad training in multiple aspects of wind energy because of the IGERT program. Faculty members appreciated the high quality of students they were able to recruit to the program, and several faculty members indicated that they would not have been able to recruit the same caliber of students to ISU were it not for the WESEP IGERT program. They also noted that these students were likely to take leadership positions after graduation. In addition, they found it useful to have two years of funding from the program to support graduate students.

Faculty members noted that they had broader opportunities for collaboration within and outside of the university because of the WESEP IGERT program. They reported learning new things and indicated that they were given the flexibility to research topics and areas they would not have been able to work on without the WESEP IGERT program. They indicated that the program had developed strong ties with industry and companies, and was seen as a highlight in the College of Engineering. They reported that interdisciplinary teaching was encouraged and supported.

Overall, faculty members felt that the WESEP IGERT was a strong program that was creating future leaders in the field of wind energy. They felt that it allowed them to spend more time focusing on their research, and to do research projects that they would not have otherwise had time or funding to pursue. They also felt that it was a very unique program that was not being replicated elsewhere.

Challenges and Suggestions for Program Improvement

One faculty member noted that it is difficult to support a WESEP IGERT student for a four-year period, but noted that the College of Engineering does provide some bridge funding when needed.

Faculty members spoke of trying to increase collaborations with industry, but noted challenges with doing research on an academic timeline rather than at the fast-pace of industry, which is quarterly. They also noted that it could be challenging to work with industry due to limitations for faculty and their students and post-docs not being able to publish all of their findings when working with what is often considered to be proprietary information by industry.

Overall, faculty members reported few challenges or suggestions for program improvement, noting that they were very happy with the program. Faculty members discussed ways to continue and grow the program after the NSF-funding ends.

Administration Interviews

Individual interviews were completed with three ISU College deans. While extensive notes were taken during and immediately after the interviews, and the analysis of the interviews is based on these notes, the details of the discussions are presented with the intention of being succinct.

The deans were all uniformly enthusiastic about the strength and success of the WESEP IGERT program. They pointed to the dual degrees that WESEP has fostered is a "real plus for the students" and that "the process for dual degrees has been streamlined; a major accomplishment at ISU as the WESEP graduates should have more degrees of opportunities in their future careers".

The Deans all expressed interest in seeing that the Program continue to thrive at ISU. They stated uniformly that ISU administration is strongly in favor of WESEP leadership approaching NSF Program Managers to make the case for a renewal of and continuation of NSF funding for WESEP per se or for a repackaged WESEP program in-kind; perhaps with ISU institutional engagement including institutional co-sponsorship. NSF programs such as "data enabled science and engineering" and "innovations at the nexus of food, energy and water systems" may be prime targets.

Whether or not NSF funding was available to support or co-support the continuation of the existing WESEP or a repackaged "next generation WESEP", the Deans suggested that a contemporaneous and parallel course of action be embarked upon. They suggested that the present WESEP Leadership Team, including but not limited to, Jim McCalley, Gene Takle, John Jackman, Partha Sakar, Sri Sritharan, Ganeesh Rajogopalan, Daji Qiao, Anupam Sharma, and others so engaged, should produce a "Sustainability Plan" (SP) and an accompanying "Plan of Action" (PoA). The SP should emphasize the cross-disciplinary nature of WESEP, the dual degree opportunities that WESEP students have been afforded and the "outreach to the Ames community, especially K-12 students". The Leadership Team's SP would be accompanied by a well scripted PoA that would contain timelines and funding needs and requirements.

Templates which presently exist at ISU for institutionally supported cross-disciplinary programs are: Bio-Informatics and Human-Computer Interactions. The ISU Graduate School has a portfolio of "providing financial incentives for inter-disciplinary programs", and WESEP includes 25 faculty from 10 departments in 3 colleges, "for administrative support", and for "laboratory and research support for the PI's". It was also noted that there is a strong, existing need for the overall PI of WESEP to have an Administrative Assistant and that if WESEP were to continue in some form, such a position needed to be part of the plan. Thus WESEP Leadership has several templates that can be used immediately to put together the aforementioned SP and the PoA.

It was also noted that the inclusion of Statistics into WESEP has been a strong plus for the overall program as 'Statistics is a huge enabler". However the issues of the difficulty of Statistics majors being able to pursue dual degrees, i.e. Statistics and WESEP, were admittedly difficult because of the construct of the Statistics curriculum and qualifying

exam requirements. Nonetheless, following the meetings with the deanery, a meeting with Statistics leadership was arranged, and there resulted a sincere expression of interest in attempting to overcome the complications of melding WESEP and Statistics curricula into a manageable set, in a timely manner.

The previous suggestion was again made that WESEP take advantage of a professional communications videographer in COE, Bill Beach, and produce a glitzy two minute WESEP recruitment video that would be available online at ISU.

The deans again mentioned that they were pleased with the WESEP summer and or fall conferences that have been held previously as they greatly helped facilitate faculty interactions and were well received by the ISU administration hierarchy. They suggested holding these conferences/workshops routinely. It was noted the Iowa public is strongly in favor of renewable energy, particularly wind related, versus other sources of energy and would attend such public conferences and workshops.

Appendix A. Annual Student Survey

WESEP IGERT Student Survey 2016

You have been selected to participate in this study because of your involvement as a graduate student in the Iowa State University Wind Energy Science, Policy, and Engineering IGERT program. We are trying to learn more about the IGERT program and its impact on graduate students and faculty members. In order to do this, we are asking you to complete this short survey, which should take about 10 minutes of your time. Your responses are extremely valuable in helping us to improve the program.

Your responses to the survey are confidential. All individual responses will be aggregated and reported as a group. If you have any questions, please feel free to contact Brandi Geisinger, brandige@iastate.edu, at 294-9622.

Throughout this survey, we use the term 'home discipline' to describe your primary field or department outside of WESEP.

What semester did you first start the wind energy graduate program?

- ○ Fall
- ○ Spring
- ○ Summer

What year did you first start the wind energy graduate program?

- ○ 2012
- ○ 2013
- ○ 2014
- ○ 2015
- ○ 2016

Have you received formal training or taken courses in the following areas? 'Training' includes workshops, seminars, retreats, special sessions within a course, etc. Check all that apply.

- ☐ Responsible conduct of research (ethics)
- ☐ Statistics
- ☐ "Bridge" courses to learn background content knowledge outside your field
- ☐ Research methods
- ☐ State-of-the-art instrumentation
- ☐ Professional speaking/ presentation skills
- ☐ Communicating to people outside your home discipline
- ☐ Professional writing
- ☐ Communicating to the general public
- ☐ Working on a team research project

How well prepared do you feel to do each of the following tasks?

	Not Prepared	At Little Prepared	Somewhat Prepared	Mostly Prepared	Very Prepared
Conduct high-quality research	○	○	○	○	○
Communicate with people inside your field	○	○	○	○	○
Understand and work in an academic setting	○	○	○	○	○
Conduct research in an ethical manner	○	○	○	○	○
Present research findings to scientific peers	○	○	○	○	○
Know your own discipline in depth	○	○	○	○	○
Work in teams of researchers from more than one discipline	○	○	○	○	○
Work in research teams within your discipline	○	○	○	○	○
Collaborate with international scientists	○	○	○	○	○
Write research articles or books	○	○	○	○	○
Communicate with people outside your field	○	○	○	○	○
Communicate research findings to the general public	○	○	○	○	○
Work outside of academia (industry, public sector)	○	○	○	○	○

Please indicate the extent to which you agree or disagree with the following statements about your program.

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I am able to study my field in as much depth as I like	○	○	○	○	○
I have developed the ability to communicate and work on research problems with researchers from more than one discipline	○	○	○	○	○
I experience high demands on my time from my academic program	○	○	○	○	○
I receive adequate opportunities to network with researchers outside this university	○	○	○	○	○
I am familiar with current research being conducted in my field in foreign countries	○	○	○	○	○
I have been prepared to conduct research outside my institution (e.g., in an internship)	○	○	○	○	○
I am being prepared for a wide range of career possibilities	○	○	○	○	○
I am part of a strong student community	○	○	○	○	○

With which of the following types of people have you worked on research projects while in your current graduate program? Check all that apply.

- ☐ Faculty at my institution in my home department
- ☐ Faculty at my institution in other departments
- ☐ Faculty at other universities in the United States
- ☐ International faculty members
- ☐ Industrial scientists in Iowa
- ☐ Industrial scientists in the United States (outside of Iowa)
- ☐ International industrial scientists
- ☐ Government laboratory scientists on the ISU campus
- ☐ Public/government laboratory scientists in the United States
- ☐ International public/government laboratory scientists
- ☐ Policymakers or planners
- ☐ Other scholars or consultants

What type of internships have you participated in as part of the IGERT program? Check all that apply.

- ☐ Private sector industry
- ☐ Business
- ☐ Public sector laboratories or agencies
- ☐ I have not participated in an internship as part of the IGERT program

Which of the following experiences have been part of your graduate training? Check all that apply.

- ☐ Working on a research project involving multiple disciplines
- ☐ Working on a research project with other students who share a similar disciplinary background to my own
- ☐ Working on a team research project
- ☐ Working on a research project with other students with disciplinary backgrounds different from my own

Please provide counts of any professional publications related to wind energy on which you were the PRIMARY AUTHOR during the past year.

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Please provide counts of any professional publications related to wind energy on which you were a CO-AUTHOR (not the primary author) during the past year.

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Of the professional publications related to wind energy you listed in the two previous questions, how many of them included students or faculty from a discipline other than your own, industrial scientists, public or governmental employees or international scientists as either the primary author or a co-author?

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

How many of each of the following are you currently in the process of authoring or coauthoring?

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Have you engaged in any of the following research activities in the last year? Check all that apply.

- ☐ Published research findings in a journal outside your home discipline
- ☐ Presented research findings at a conference outside your home discipline

Please provide the following information for conferences or workshops you have attended.

	Attended a Conference	Presented a Poster	Presented a Paper
At home institution	☐	☐	☐
Within the U.S. (outside the home institution)	☐	☐	☐
Outside the U.S.	☐	☐	☐

How useful was WESEP 594 (the Real Time Research Collaboratives (RTRC)s) in each of the following areas?

	Not At All Useful	A Little Useful	Somewhat Useful	Very Useful
Learning how to do research	○	○	○	○
Stimulating and enhancing your research productivity	○	○	○	○
Facilitating your interdisciplinary work	○	○	○	○
Enhancing your communication skills	○	○	○	○
Enhancing your awareness of and ability to respond to ethical issues	○	○	○	○
Learning about environmental and policy issues	○	○	○	○
Making industry connections	○	○	○	○

Please indicate the extent to which you disagree or agree with each of the following statements.

After I graduate from graduate school...

	Strongly Disagree	Disagree	Neither Disagree nor Agree	Agree	Strongly Agree
I would prefer a career in academia.	○	○	○	○	○
I will be well-prepared for a career in academia.	○	○	○	○	○
I would prefer an career in industry	○	○	○	○	○
I will be well-prepared for a career in industry.	○	○	○	○	○
I would prefer a career in government, non-profit agencies, or NGOs.	○	○	○	○	○
I will be well-prepared for a career in government, non-profit agencies, or NGOs.	○	○	○	○	○
I would prefer a career that involves doing research.	○	○	○	○	○
I will be well-prepared for a career that involves doing research.	○	○	○	○	○

Do you plan to graduate within the next year (Fall 2016, Spring 2017, or Summer 2017)?

- ○ Yes
- ○ No

What are your plans after graduation from the program? (e.g., Have you started looking into career opportunities? Do you plan to go into academia or industry? Etc.)

What do you view to be the highlight of your experience in the WESEP IGERT program?

Were there experiences in the WESEP IGERT program that you felt were lacking or not very useful? Please explain.

What suggestions do you have to improve the IGERT program?

Please use this space to discuss any other comments or concerns you may have.

Thank you for completing the survey. Please click >> to submit.

Appendix B. Annual Faculty Survey

2016 WESEP IGERT Faculty Survey

You have been selected to participate in this study because of your involvement as a faculty member in the Iowa State University Wind Energy Science, Policy, and Engineering IGERT program. We are trying to learn more about the IGERT program and its impact on graduate students and faculty members. In order to do this, we are asking you to complete this short survey, which should take about 10 minutes of your time. Your responses are extremely valuable in helping us to improve the program.

Your responses to the survey are confidential. All individual responses will be aggregated and reported as a group. If you have any questions, please feel free to contact Brandi Geisinger, brandige@iastate.edu, at 294-9622.

Throughout this survey, we use the term 'home discipline' to describe your primary field or department outside of WESEP.

In what ways do you participate in the IGERT project?

- ☐ I advise IGERT graduate students
- ☐ I serve on IGERT dissertation committees
- ☐ I conduct IGERT-related research
- ☐ I attend IGERT workshops or lectures
- ☐ IGERT graduate students work in my lab
- ☐ I teach IGERT courses
- ☐ I contribute to IGERT project management
- ☐ Other (please specify):

Please indicate whether your IGERT participation has resulted in your spending less time, equal time, or more time on each of the non-IGERT responsibilities listed below.

	Less Time	Equal Time	More Time
Teaching department courses	○	○	○
Advising department students	○	○	○
Engaging in department leadership activities	○	○	○
Conducting research with other departmental faculty	○	○	○

Please provide counts of any professional publications related to wind energy on which you were the PRIMARY AUTHOR during the past year.

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Please provide counts of any professional publications related to wind energy on which you were a CO-AUTHOR (not the primary author) during the past year.

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Of the professional publications related to wind energy you listed in the two previous questions, how many of them included students or faculty from a home discipline other than your own, industrial scientists, public or governmental employees or international scientists as either the primary author or a co-author?

	0	1	2	3	4	5	6	7	8	9	10
Journal articles in refereed journals											
Conference paper or poster presentations											
Book chapters											
Books											
Patent applications											
Approved patents											
Grant proposals											
All other publications											

Have you engaged in any of the following research activities in the last year? Check all that apply.

- ☐ Published research findings in a journal outside your home discipline
- ☐ Presented research findings at a conference outside your home discipline

To what extent do you agree or disagree with the following statements about the impact that participating in the IGERT project has had on your professional life?

	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
I have been exposed to new ideas outside my area of knowledge	○	○	○	○	○
I have met faculty in other departments whom I would not otherwise have met	○	○	○	○	○
I am able to work with a greater variety of students	○	○	○	○	○
I am more likely to conduct research with colleagues in disciplines outside my own	○	○	○	○	○
My teaching has become more interdisciplinary	○	○	○	○	○
I am more likely to consider team-teaching with a faculty member outside my department	○	○	○	○	○
I am in a better position to obtain new research grants	○	○	○	○	○
I have learned new research techniques	○	○	○	○	○
I can explore research topics that would not otherwise be funded	○	○	○	○	○
I am able to work with students who are better qualified than non-IGERT students in my department	○	○	○	○	○
I have less time to conduct my own research	○	○	○	○	○

What strategies were used to attract a highly qualified, diverse pool of applicants for the IGERT program?

Has the presence of the IGERT grant had an impact on your departmental admissions in any of the following ways?					
	Strongly Disagree	Disagree	Neither Agree nor Disagree	Agree	Strongly Agree
We have attracted better qualified students	○	○	○	○	○
We have attracted more students	○	○	○	○	○
We have attracted more students who are U.S. citizens	○	○	○	○	○
We have attracted students who have inter/multidisciplinary backgrounds	○	○	○	○	○
We have experienced increased admissions inquiries into our program	○	○	○	○	○
We have attracted students from a collectively more varied disciplinary background	○	○	○	○	○
We have attracted students with different career goals	○	○	○	○	○
We have attracted more underrepresented minority students	○	○	○	○	○
We have attracted more female students	○	○	○	○	○
We have attracted more international students	○	○	○	○	○

How well do you think your IGERT graduate students are being prepared for the following tasks?						
	Not Prepared	A Little Prepared	Somewhat Prepared	Mostly Prepared	Very Prepared	Not Sure / Not Applicable
Conduct high-quality research	○	○	○	○	○	○
Present research findings to scientific peers	○	○	○	○	○	○
Know their own discipline in depth	○	○	○	○	○	○
Communicate with people inside their field	○	○	○	○	○	○
Work in research teams within their discipline	○	○	○	○	○	○
Understand and work in an academic setting	○	○	○	○	○	○
Write research articles or books	○	○	○	○	○	○
Conduct research in an ethical manner	○	○	○	○	○	○
Communicate with people outside their field	○	○	○	○	○	○
Work in teams of researchers from more than one discipline	○	○	○	○	○	○
Work outside of academia (industry, public sector)	○	○	○	○	○	○
Collaborate with international scientists	○	○	○	○	○	○
Communicate research findings to the general public	○	○	○	○	○	○

How well do you think your graduate students **who are not IGERT students** are being prepared for the following tasks?					
	Not Prepared	A Little Prepared	Somewhat Prepared	Mostly Prepared	Very Prepared
Conduct high-quality research	○	○	○	○	○
Present research findings to scientific peers	○	○	○	○	○
Know their own discipline in depth	○	○	○	○	○
Communicate with people inside their field	○	○	○	○	○
Work in research teams within their discipline	○	○	○	○	○
Understand and work in an academic setting	○	○	○	○	○
Write research articles or books	○	○	○	○	○
Conduct research in an ethical manner	○	○	○	○	○
Communicate with people outside their field	○	○	○	○	○
Work in teams of researchers from more than one discipline	○	○	○	○	○
Work outside of academia (industry, public sector)	○	○	○	○	○
Collaborate with international scientists	○	○	○	○	○
Communicate research findings to the general public	○	○	○	○	○

To what extent has the IGERT grant affected your department in the following ways?					
	Not At All - 1	2	3	4	Extensively - 5
Improved the quality of faculty research	○	○	○	○	○
Altered the research scope of involved faculty	○	○	○	○	○
Improved faculty mentoring of students	○	○	○	○	○

How useful was WESEP 594: the Real Time Research Collaborative (RTRC) in each of the following areas?

	Not At All Useful	A Little Useful	Somewhat Useful	Very Useful	Not Sure / Not Applicable
Teaching students how to do research	○	○	○	○	○
Stimulating and enhancing students' research productivity	○	○	○	○	○
Facilitating students' interndisciplinary work	○	○	○	○	○
Enhancing students' communication skills	○	○	○	○	○
Enhancing students' awareness of and ability to respond to ethical issues	○	○	○	○	○
Teaching students about environmental and policy issues	○	○	○	○	○
Making industry connections	○	○	○	○	○

What suggestions do you have to improve the IGERT program?

Please use this space to discuss any other comments or concerns you may have.

Thank you for completing the survey. Please click >> to submit.