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

## 2014 Evaluation Report

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# WESEP IGERT 2014 Evaluation Report

## Executive Summary

The National Science Foundation (NSF) sponsored WESEP IGERT Program at Iowa State University (ISU) had fourteen students enrolled at the time of the October 2014 survey. Two new students entered the program in the Fall 2014. The overall assessment is that the program is progressing very well, has recognized several issues affecting student experience and performance, has been nimble in making programmatic adjustments, and is of continuing high quality. Overall the WESEP IGERT program is well managed, is highly regarded by the faculty and is especially highly regarded by the WESEP IGERT graduate students. As the program continues to mature, there are opportunities yet to be taken advantage of. In the summary below, we address student and faculty responses to the 2014 institutional surveys as well as assessments made during the on-site interviews of students, faculty and university administration.

One of the core components of the WESEP program involves facilitating and building "team research," and the program is advancing at a steady and considerable rate in this area. It should be noted that team research is central to NSF's support and to the eventual success of the WESEP IGERT program. Twelve of the fourteen students in the program are already working on team research projects and in cross-disciplinary, multi-disciplinary research settings and the program is building and enabling capacity. The students from the 2012 and 2013 cohorts embrace the real, tangible engagement of the students and the faculty involved in the program. The collective response of the students in the 2014 survey speaks to the strong endorsement and collaboration of the program by the faculty from outside of the students' home departments. The solidly positive response to the question of working on a research project involving multiple disciplines remains laudable. Students have come to enjoy the tangible benefits of interacting with fellow students who have disciplinary expertise to share with one another.

The WESEP IGERT program is well advanced into building a solid international component with most students either having already participated in international wind power activities or making plans to do so. This opportunity is recognized as a unique benefit of the program. The students expressed interests in being able to take advantage of international opportunities not only in Europe but also in Asia, Africa, Australia and other continents and countries. Their interests at the international level are quite extensive. Program leadership should pursue other global possibilities; with all due diligence for student safety of course.

There still has been little in the way of established student collaborations with industry scientists in Iowa. However there are positive signs of movement in the program with potential industry partners on the construction of giant wind turbine towers. Several faculty members and students were very positive about the possibilities. Here the Real Time Research Collaborative (RTRC) ISU WESEP 594 course is looked upon as an opportunity to bring in speakers from external communities such as the U.S. Department of Energy (DOE), AMES National Lab, and the wind energy industry. Several WESEP faculty members have appointments at the DOE Ames National Lab and that presents opportunities to invite speakers external to ISU. Likewise, industry speakers could make presentations regarding their respective research activities which could lead to collaborations with WESEP faculty and students and potential internships for students.

The changes in the RTRC have been positive from 2012 to 2013 to 2014. However the course is generally viewed in a positive vein by the students, such that: it is viewed as having a healthy mix of presentations from ISU faculty and WESEP students, and from national labs and the wind industry; in general the students found it to be very beneficial to present in class but were concerned that it might not be feasible for all students to present every semester; and students saw it as an opportunity to focus on cyclical presentations in a format and climate in which student and faculty research is presented and also one in which external speakers from the AMES Lab and Industry are invited to make their presentations in an informal, collegial setting allowing for interaction and possible collaboration building between WESEP IGERT faculty and students and industry scientists and engineers. Obviously the RTRC is a work in progress and, given the critical engagement of the students along with the flexile structure of the course, WESEP leadership should consider possible further, evolving restructuring of 594.

As an additional note, student credit for participation in the RTRC (which is required of all WESEP IGERT Fellows) is singular. Presently, WESEP students only receive a one-time credit for taking and passing 594. As they retake it semester by semester, the credit hours and grades simply replace their prior credit hours and grades; as a do-over. This needs to be changed so that the students receive credit on a semester by semester basis, cumulatively speaking; i.e. the credits need to accumulate on the students transcripts. Program leadership should address and resolve this issue.

WESEP students are making oral and poster presentations at ISU and national conferences and preparing manuscripts and publishing in the peer reviewed literature. The scholarly activity is becoming ingrained as a core component of the WESEP IGERT culture. The packaging of student PhD dissertations such that several chapters in the thesis document can constitute and justifiably become separate publications has struck a resonant chord. The intended scholarly productivity of the NSF vision is being realized in the WESEP IGERT program.

While many of the WESEP IGERT students are advancing in the art of making presentations at professional meetings and in writing manuscripts intended to be published in the peer reviewed literature, many of the students still fell challenged in their oral and writing communication skills. Most of the students feel well prepared to write peer reviewed research articles and or books. As in the 2013 survey, the 2014 survey shows that students still express a relative lack of confidence in their collective ability to communicate their research findings. It may be that program leadership should consider engaging the English department professor already well known to the students, or another English department faculty member, as part of the instructional program, to broaden the exposure of the students to technical writing and communication. There may already be a technical writing course offered. Oral presentations are a different challenge and WESEP 594 could and should serve as an on-campus vehicle to help develop and facilitate those skill sets, though curiously, while some WESEP students see 594 as an opportunity to hone their oral presentation skills, several of the students do not necessarily view 594 in that regard (see Table 1). Perhaps an interested faculty with expertise in ‘communication’ could be invited to attend the student presentations and offer advice therein. WESEP 594, in fact, does present students with the opportunity to compare and contrast the scientific orations of the faculty, their fellow students, and national lab and industry speakers in sharing their scientific findings and information. This allows students to develop their own styles of communicating science and technology to peers and to the public as well.

An apparent shortcoming of the WESEP IGERT program has been the enrollment of but two new IGERT Fellows in the 2014 cohort. At face value this seems to be a recruitment failure. However, program leadership has made a concerted effort to advertise the program and thus recruit via those efforts. In 2014 there were eighteen reported, documented methods of advertising and recruiting for WESEP IGERT: 1) information and fliers were sent to top engineering universities that did not offer PhDs; 2) the ISU Graduate Program coordinator sent information and fliers to counterparts at other U.S. universities; 3) the program was advertised throughout ISU departments; 4) contacted all ISU graduate applicants in the appropriate sciences and technological fields, with GPAs greater than or equal to 3.0; 5) posted on Twitter@ISU.edu; 6) posted on Facebook @ ISU Dept. of Electrical Engineering; 7) posted on ECpE website @www.ece.iastate.edu; 8) Nine IGERT Fellows attended six career fair/grad fairs around the U.S. with the goal of recruiting students; 9) had a booth at the Society of Women Engineers Conference; 10) posted on the ISU Career Management website; 11) advertised on Academic Keys; 12) sent materials describing the WESEP IGERT program opportunities to all prior 3-year WESEP REU applicants; 13) National Name Exchange; 14) WESEP IGERT professors contacted colleagues across U.S. to ask about potential students; 15) provided materials about WESEP at the IINSPIRE Annual Conference to the attending STEM students and spoke to many; 16) advertised the WESEP IGERT program on Linked In; 17) contacted all undergraduate applicants to graduate programs at ISU who expressed an interest in 'wind energy' ,via the ISU Grad School; and 18) provided materials describing the WESEP IGERT program to the ISU Coordinator for Graduate Studies , to be shared with prospective ISU graduate students in scientific and technology backgrounds.

WESEP IGERT faculty continue to rate WESEP students very highly. The WESEP IGERT Program clearly is becoming a model for graduate students on the manner and protocols on how to conduct collaborative, team research. ISU administration should take note of the success of the program in building such enabling capacity. WESEP faculty members maintain that the program has introduced them to new ideas outside of their areas of knowledge, said that they have met new faculty, and reported they are more likely to conduct research with those in other departments. WESEP has clearly garnered the attention of most of the participating faculty in the exploration of new, and likely more fundable, research topics; a very positive outcome for WESEP faculty and their students. However, several faculty members claimed that they needed to know more about the WESEP program and that information was not easily available. This may be an example of oversight on the part of faculty who have not readily or easily found information about WESEP. A one-stop WESEP web site might be useful and helpful herein.

Several faculty members were still concerned about the students' source or sources of support after the two-year guarantees in the program. As stated previously, perhaps multiple other opportunities should be taken advantage of via building partnerships with industry, federal laboratories, funding from agencies like the DOE, the National Aeronautics and Space Administration, the U.S. Department of the Interior, the U.S. Department of Agriculture, state of Iowa agencies, the National Oceanic and Atmospheric Administration, the National Renewable Energy Laboratory, international partners and so on.

WESEP student internships and work-study opportunities with industry need to be brokered by program leadership and the faculty. Materials can be made available to the students which describe

opportunities through such professional societies as: the American Meteorological Society (AMS); the American Geophysical Union; the Institute of Electrical and Electronic Engineers; the Physics Society of America; the National Oceanic and Atmospheric Administration Knauss Fellows Program; other fellows and internship programs in-kind on Capitol Hill in the Nation's Capital. These programs allow for students or recent PhDs to go to Capitol Hill, serve as science and technical/engineering advisers and position paper writers to staffers of congressional representatives to meet with communications media, policy makers and so on. Most of the awards are quite lucrative and provide living and travel stipends, etc. Here a One-Stop Shopping WESEP Website would be an invaluable tool and resource for WESEP students and faculty. WESEP leadership should hire a web creator and get this done. For example here is a 1/15/15 message from the AMS: **"***The American Meteorological Society (AMS) seeks candidates with backgrounds in the Earth sciences for the 2015-2016 AMS Congressional Science Fellowship. Fellows participate in the legislative process by joining a Congressional office of their choosing in the United States Senate or House of Representatives. Typical duties include developing legislation, negotiating legislative compromises, writing speeches and briefing memos, meeting with constituents, and conducting background research. The AMS Congressional Science Fellow will join a class of over 200 AAAS Science and Technology Policy Fellows to help shape federal policy. Fellows must be U.S. citizens and complete all requirements for their Ph.D. prior to the start of the fellowship year, which runs from September 1, 2015 through August 31, 2016. Support includes a stipend ($55,000), and assistance with moving, travel, and health care expenses. The application deadline is March 15, 2015. Details are available at www.ametsoc.org/csf, and/or contact Paul Higgins at phiggins@ametsoc.org."*

There are several additional opportunities for students that need to be mentioned here. They include: various DOE student and internships programs; the Boren Fellowship, related to national security in the U.S. and provides support for 1 year for the federal government; NSF's East Asia and Pacific Summer Institutes for U.S. graduate students (EAPSI); the German Chancellor Fellowship for tomorrow's leaders at 30/year including 10 from the U.S., 10 from China and 10 from Russia; and the Robert Bosch Foundation Fellowship Program of 3-6 months in Germany in which Fellows work as consultants in their field of expertise at leading public and or private institutions in Germany. These opportunities would also help build out the international component of the WESEP IGERT program.

There are presently 14 students fully enrolled in the WESEP IGERT program. Given the burn rate of financial student support, and the commitment of two years of funding to each "new" student, there are concerns about the financial sustainability of the program. WESEP will need approximately $0.5M in Year 4 and perhaps $1.0M in Year 5 in non-NSF funds to sustain the program. Where will these funds come from? The NSF proposal details the costs but needs to be re-visited to ensure that these students do not go wanting in their Years 4 and 5 of the PhD program. While three years for time from onset to conclusion is typical for a student in a PhD program, four years is more likely and since some students have entered the PhD program with no MS degree experience, a full five years to PhD could occur. The above said, the ISU institutional support of the program, up to $835K, is necessary and laudable. It provides necessary stability. Given the above reality, it would be prudent for the program to look to internships and work study with private industry and with federal laboratories to meet the funding needs of the program. WESEP leadership and the ISU Chief Research Officer need to engage the appropriate entities. ISU has

invested in laboratory and computing facilities that industry covets. Thus ISU has leveraged physical, computational, technological and intellectual resources not found in any industrial or government lab. ISU can make these facilities available to industry and government scientists and engineers in return for support of students. ISU administration has made it clear that it can and will "Back-Fill" and "Gap-Fill" funding shortcomings. WESEP leadership needs to take advantage of these offers as needed.

If WESEP students work as interns or work study students in industry or federal laboratories and or in university facilities with support from these external (from the university) entities, issues related to students publications, intellectual property rights of ownership, patent applications, patents, and so on, must be addressed. ISU is a public university and its students must be able to publish their work. Meanwhile industry likes to protect its investments by cataloguing findings, results, new findings, and even data as "proprietary". Here, ISU intellectual property and patent attorneys along with upper research administration must be engaged to insure that the deals cut are fair to all. ISU upper administration can and will negotiate the appropriate contractual arrangements regarding patents and intellectual property.

Industry and government scientists, engineers, mathematicians, statisticians, etc., who are advising and or working with WESEP IGERT students, and have appropriate pedigrees (a PhD), could be given adjunct appointments at ISU and certainly co-author papers, presentations, patent applications, and so on. ISU administrators are uniformly enthusiastic and positive about this possibility. College of Engineering administration has vast experience in how to get this done.

# 1 Introduction and Methodology

## 1.1 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 engineering, atmospheric science-meteorology, agriculture-economics, and journalism-communication. 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.

## 1.2 Evaluation Methods and Procedures

As a key part of the annual evaluation of the program, students enrolled in the WESEP IGERT program are asked to fill out a survey related to their experiences in the program and research productivity. This survey was distributed in October 2014 and reflects the responses of all fourteen students presently enrolled in the program.

As a separate but related component of the annual programmatic evaluation process, an annual survey for faculty engaged in the program was distributed in October 2014 and reflects the responses of 18 of 25 faculty who are affiliated with the program and have been involved in a variety of ways.

In the Fall 2014, there were 25 faculty involved in the program and 14 students enrolled in the program. Two students in the original F12 cohort left the WESEP IGERT program and ISU more than a year ago and were not included in this annual evaluation; though their evaluations were included in the 2013 WESEP IGERT Report. It is noted that one of those students followed his major professor to another university and the other student changed her field of interest and matriculated at another university. Both spoke highly of WESEP.

The external evaluator reviewed all data collected, performed interviews with all students in person and on campus, and with selected faculty and administrators, and developed constructive conclusions regarding the 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. Additionally, the student focus group was audio-recorded, with the consent of all participants, and transcribed for analysis. 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 students, faculty, and university administrators involved with the program. Generally the interviews with students, faculty, and university administrators were thirty minutes in length. Additionally, the students were invited to participate in a one hour focus group discussion. Exit interviews and annual surveys of graduates of the program are not yet viable.

# 2 Results

The results are presented below in four sections: 2.1) Annual student survey; 2.2) Annual faculty survey; 2.3) Student focus groups and interviews; and 2.4) Institutional data. 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.

## 2.1 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 and Publications, and 2.1.3) Learning, Preparation, and Suggestions for Improvement. Each of these subsections is comprised of similar questions. Fourteen students are currently enrolled in the WESEP IGERT program, including four students who entered the program in the Fall 2012 cohort, eight students who entered the program in Spring, Summer, or Fall of 2013, and two students who entered the program in Fall 2014. All 14 students currently enrolled in the program completed the survey. Not all of the students responded to every question.

### 2.1.1 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. High proportions of the 2012 and 2013 students indicated that they had received training in most of the areas listed. Students in the 2014 cohort reported that they had received less training, which is expected since these students had been in the program for less than one semester. Nearly 93% of all WESEP IGERT students reported that they had received formal training in the responsible conduct of research, and over three-fourths of the students reported that they had received formal training in research methods. Over 70% of the students also reported that they had received formal training in statistics, bridge courses to learn background content outside of their field, communicating to people outside their home discipline, and working on a team research project. More than half of the students additionally indicated that they had received formal training related to communicating to the general public. Only 43% of students reported that they had received formal training related to state-of-the-art instrumentation, and only 36% reported receiving formal training related to professional speaking or presentation skills. Less than a quarter of the students (21.4%) reported that they had received formal training related to professional writing. As shown in Figure 1, the total percentage of WESEP IGERT students reporting formal training increased in seven of the ten areas listed from the time of the 2013 survey to the time of the 2014 survey.

**Table 1: Formal Training Received**

| | 2012 Cohort n | 2012 Cohort (%) | 2013 Cohort n | 2013 Cohort (%) | 2014 Cohort n | 2014 Cohort (%) |
|---|---|---|---|---|---|---|
| Responsible conduct of research (ethics) | 3 | 75.0 | 8 | 100.0 | 2 | 100.0 |
| Statistics | 3 | 75.0 | 7 | 87.5 | 0 | 0.0 |
| "Bridge" courses to learn background content knowledge outside your field | 3 | 75.0 | 6 | 75.0 | 1 | 50.0 |
| Research methods | 2 | 50.0 | 8 | 100.0 | 1 | 50.0 |
| State-of-the-art instrumentation | 1 | 25.0 | 4 | 50.0 | 1 | 50.0 |
| Professional speaking/presentation skills | 1 | 25.0 | 3 | 37.5 | 1 | 50.0 |
| Communicating to people outside your home discipline | 3 | 75.0 | 7 | 87.5 | 0 | 0.0 |
| Professional writing | 1 | 25.0 | 2 | 25.0 | 0 | 0.0 |
| Communicating to the general public | 2 | 50.0 | 7 | 87.5 | 0 | 0.0 |
| Working on a research team project | 4 | 100.0 | 5 | 62.5 | 1 | 50.0 |

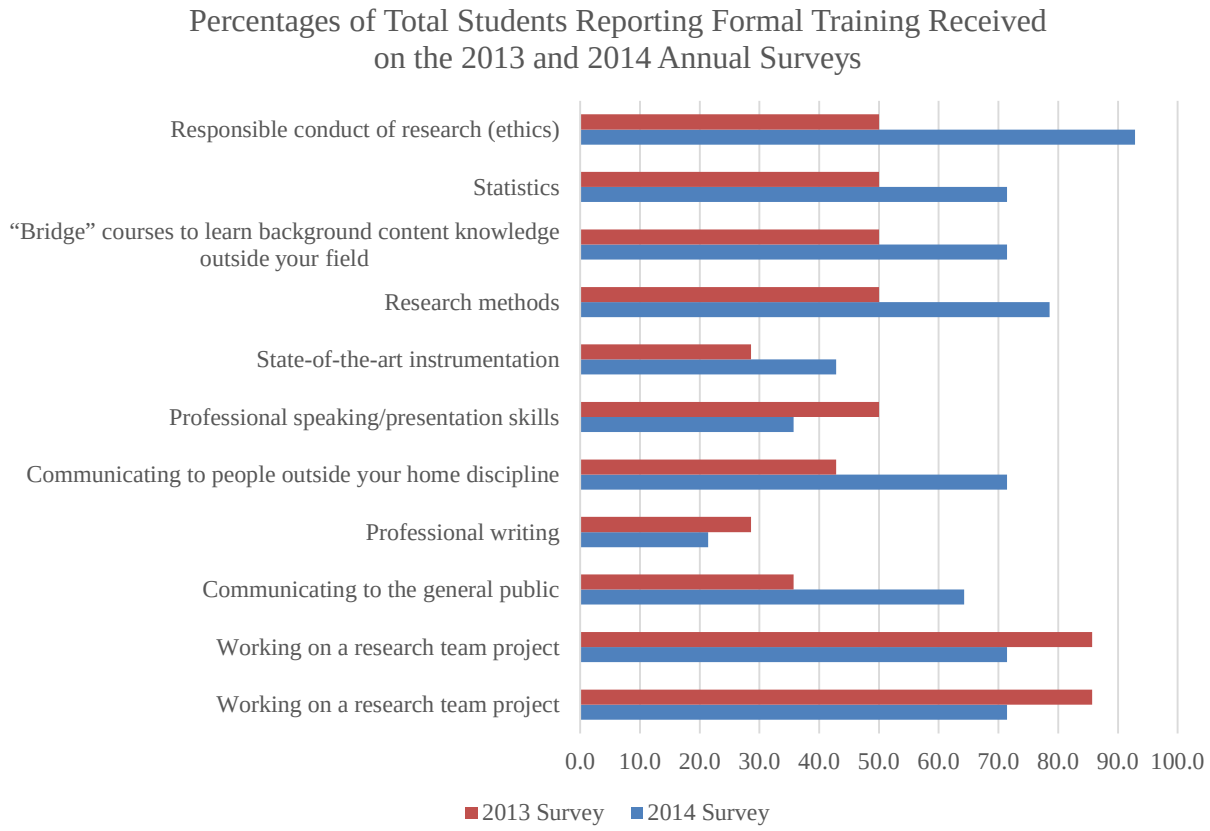


Figure 1. Percentages of total students reporting formal training received on 2013 and 2014 annual surveys. (2013 n = 14, 2014 n = 14).

Students were asked about the types of collaborators they were working with during their graduate education in the WESEP IGERT program (Table 2). All students reported that they were collaborating with ISU faculty in their home department, and over half of students reported that they were collaborating with ISU faculty in other departments. No students reported working with faculty members at other institutions within the U.S., but two students reported working with faculty members at foreign institutions. As shown in Figure 2, the percentages of total WESEP IGERT student collaborations have increased from the time of the 2013 annual survey to the time of the 2014 annual survey.

**Table 2: Students' Collaborators**

| | 2012 Cohort n | 2012 Cohort (%) | 2013 Cohort n | 2013 Cohort (%) | 2014 Cohort n | 2014 Cohort (%) |
|---|---|---|---|---|---|---|
| Faculty at my institution in my home department | 4 | 100.0 | 8 | 100.0 | 2 | 100.0 |
| Faculty at my institution in other departments | 2 | 50.0 | 5 | 62.5 | 1 | 50.0 |
| Faculty at other universities in the United States | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| International faculty members | 1 | 25.0 | 1 | 12.5 | 0 | 0.0 |
| Industrial scientists in Iowa | 1 | 25.0 | 0 | 0.0 | 0 | 0.0 |
| Industrial scientists in the United States (outside of Iowa) | 0 | 0.0 | 1 | 12.5 | 1 | 50.0 |
| International industrial scientists | 1 | 25.0 | 1 | 12.5 | 0 | 0.0 |
| Public/government laboratory scientists in the United States | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| International public/government laboratory scientists | 2 | 50.0 | 1 | 12.5 | 0 | 0.0 |
| Policymakers or planners | 2 | 50.0 | 0 | 0.0 | 0 | 0.0 |
| Government laboratory scientists on the ISU campus | 0 | 0.0 | 1 | 12.5 | 0 | 0.0 |
| Other scholars or consultants | 1 | 25.0 | 0 | 0.0 | 1 | 50.0 |

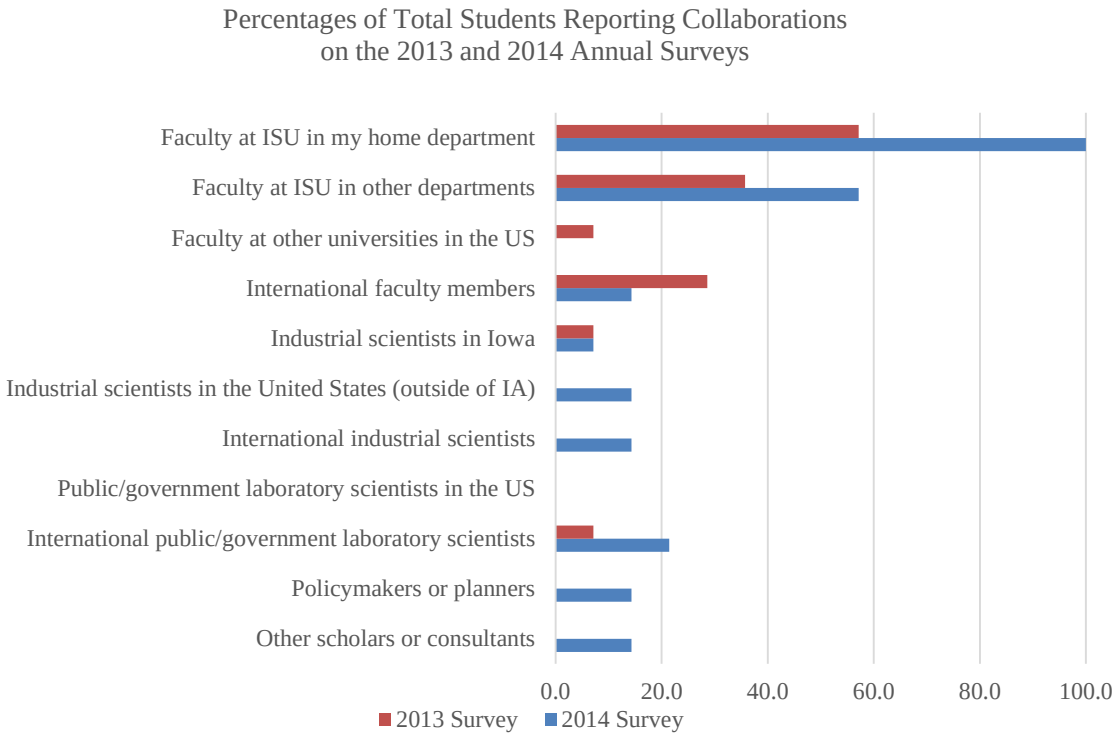


Figure 2. Percentages of total students reporting collaborations on 2013 and 2014 annual surveys. (2013 n = 14, 2014 n = 14).

Students were also asked about the types of internships in which they had participated as part of the WESEP IGERT program (Table 3). Three of the four students from the 2012 cohort indicated that they had participated in an internship, though no students from the 2013 or 2014 cohorts had participated in an internship at this point in the program. Of the three students who had participated in internships, two reported private sector industry internships and one reported an internship with a public sector laboratory or agency. The total number of students in the program who had participated in internships increased slightly from the time of the 2013 annual survey to the time of the 2014 annual survey, since no students had participated in an internship at the time of the 2013 annual survey (not shown in a figure due to low numbers).

**Table 3: Internships in which Students Participated**

| | 2012 Cohort n | 2012 Cohort (%) | 2013 Cohort n | 2013 Cohort (%) | 2014 Cohort n | 2014 Cohort (%) |
|---|---|---|---|---|---|---|
| Private sector industry | 2 | 50.0 | 0 | 0.0 | 0 | 0.0 |
| Business | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Public sector laboratories or agencies | 1 | 25.0 | 0 | 0.0 | 0 | 0.0 |
| I have not yet participated in an internship as part of the IGERT program | 1 | 25.0 | 8 | 100.0 | 2 | 100.0 |

### 2.1.2 Student Research, Publications and Other Scholarly Activity

Students were asked to respond to seven 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. All but one of the 14 WESEP IGERT students indicated that they had worked on a team research project, and 11 of the 14 WESEP IGERT students indicated that they had worked on a research project with students who had different disciplinary backgrounds than their own. Nine students indicated that they had worked on a research project involving multiple disciplines. Eight students reported that they worked on a research project with students who shared a similar disciplinary background to their own. The percentage of students working on each type of collaborative research project increased from the time of the 2013 annual survey to the time of the 2014 annual survey (Figure 3).

**Table 4: Collaborative Research Projects**

| | 2012 Cohort n | 2012 Cohort (%) | 2013 Cohort n | 2013 Cohort (%) | 2014 Cohort n | 2014 Cohort (%) |
|---|---|---|---|---|---|---|
| Working on a research project involving multiple disciplines | 3 | 75.0 | 6 | 75.0 | 0 | 0.0 |
| Working on a research project with other students who share a similar disciplinary background to my own | 3 | 75.0 | 5 | 62.5 | 0 | 0.0 |
| Working on a team research project | 4 | 100.0 | 7 | 87.5 | 2 | 100.0 |
| Working on a research project with other students with disciplinary backgrounds different from my own | 3 | 75.0 | 7 | 87.5 | 1 | 50.0 |

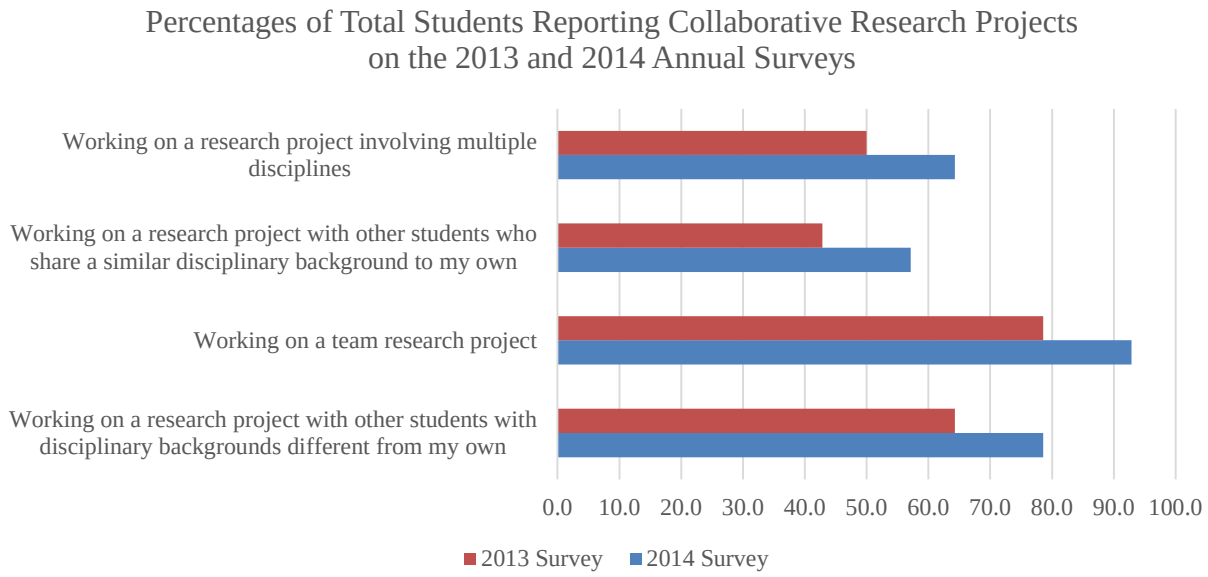


Figure 3. Percentages of total students reporting collaborative research projects on 2013 and 2014 annual surveys. (2013 n = 14, 2014 n = 14).

As shown in Table 5, no current WESEP IGERT students reported that they had presented research findings at a conference outside their home discipline in the last year. One of the 14 WESEP IGERT students, from the 2013 cohort, reported publishing research findings in a journal outside his home discipline in the last year. At the time of the 2013 annual survey, one student reportedly had presented research findings at a conference outside his home discipline while no students reported publishing research findings in a journal outside their home discipline (not shown in a figure due to low numbers).

**Table 5: Interdisciplinary Research Publications**

| | 2012 Cohort n | 2012 Cohort (%) | 2013 Cohort n | 2013 Cohort (%) | 2014 Cohort n | 2014 Cohort (%) |
|---|---|---|---|---|---|---|
| Published research findings in a journal outside your home discipline. | 0 | 0.0 | 1 | 12.5 | 0 | 0.0 |
| Presented research findings at a conference outside your home discipline. | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

Table 6 displays reported student publications and presentations related to wind energy that were completed in the last year. 2014 cohort students reported no publications within the last year at this time. One 2012 and one 2013 student reported serving as the primary author of a journal article in a refereed journal, while one 2012 and one 2013 student reported serving as a co-author, and two 2012 students reported having a journal article in process; 2013 students reported having a journal article in process six times. One 2012 and one 2013

student reported publishing a journal article with an interdisciplinary author or interdisciplinary co-author(s). 2012 cohort students reported serving as the primary author on a total of eight conference papers, including paper and poster presentations. Three 2012 students reported serving as a co-author, and two students reported having a conference paper and poster presentation in process. 2012 cohort students reported working with an interdisciplinary author/co-author(s) on their conference paper or poster presentations on three occasions, and one 2012 student served as a primary author on a grant proposal. 2013 cohort students reported serving as a primary author on six conference paper or poster presentations. Two 2013 students reported serving as a co-author, and students reported having a conference paper or poster-presentation in process on eight occasions (two students reported having two conference papers or poster-presentations in process). No WESEP IGERT students reported working on book chapters, books, patent applications, or approved patents. One 2013 student reported serving as a primary author on another type of publication. As shown in Figure 4, students' publications in wind energy over the last year have increased from the time of the 2013 survey to the time of the 2014 survey. In particular, there was a sharp increase in the number of times that students had served as a primary author on a conference presentation, with only four of these presentations having been reported in 2013 while a total of 14 of these presentations occurred in 2014.

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

| | 2012 Cohort n | 2012 Cohort mean | 2012 Cohort s.d. | 2013 Cohort n | 2013 Cohort mean | 2013 Cohort s.d. | 2014 Cohort n | 2014 Cohort mean | 2014 Cohort s.d. |
|---|---|---|---|---|---|---|---|---|---|
| Journal articles in refereed journals | | | | | | | | | |
| Primary Author | 1 | 0.25 | 0.500 | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Co-author | 1 | 0.25 | 0.500 | 1 | 0.13 | 0.354 | 0 | 0.00 | -- |
| Interdisciplinary author/co-authors | 1 | 0.25 | 0.500 | 1 | 0.13 | 0.354 | 0 | 0.00 | -- |
| In process | 2 | 0.50 | 0.577 | 6 | 0.75 | 0.707 | 0 | 0.00 | -- |
| Conference paper or poster presentations | | | | | | | | | |
| Primary Author | 8 | 0.75 | 2.00 | 6 | 0.75 | 0.886 | 0 | 0.00 | -- |
| Co-author | 3 | 0.75 | 0.500 | 2 | 0.25 | 0.463 | 0 | 0.00 | -- |
| Interdisciplinary author/co-authors | 3 | 0.75 | 0.957 | 0 | 0.00 | -- | 0 | 0.00 | -- |
| In process | 2 | 0.50 | 0.577 | 8 | 1.00 | 0.756 | 0 | 0.00 | -- |
| Book chapters | | | | | | | | | |
| Primary Author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Co-author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Interdisciplinary author/co-authors | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| In process | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Books | | | | | | | | | |
| Primary Author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Co-author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Interdisciplinary author/co-authors | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| In process | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Patent applications | | | | | | | | | |
| Primary Author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Co-author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Interdisciplinary author/co-authors | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| In process | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |

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

| | 2012 Cohort n | 2012 Cohort mean | 2012 Cohort s.d. | 2013 Cohort n | 2013 Cohort mean | 2013 Cohort s.d. | 2014 Cohort n | 2014 Cohort mean | 2014 Cohort s.d. |
|---|---|---|---|---|---|---|---|---|---|
| Approved patents | | | | | | | | | |
| Primary Author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Co-author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Interdisciplinary author/co-authors | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| In process | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Grant proposals | | | | | | | | | |
| Primary Author | 1 | 0.25 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Co-author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Interdisciplinary author/co-authors | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| In process | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| All other publications | | | | | | | | | |
| Primary Author | 0 | 0.00 | -- | 1 | 0.13 | 0.354 | 0 | 0.00 | -- |
| Co-author | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| Interdisciplinary author/co-authors | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |
| In process | 0 | 0.00 | -- | 0 | 0.00 | -- | 0 | 0.00 | -- |

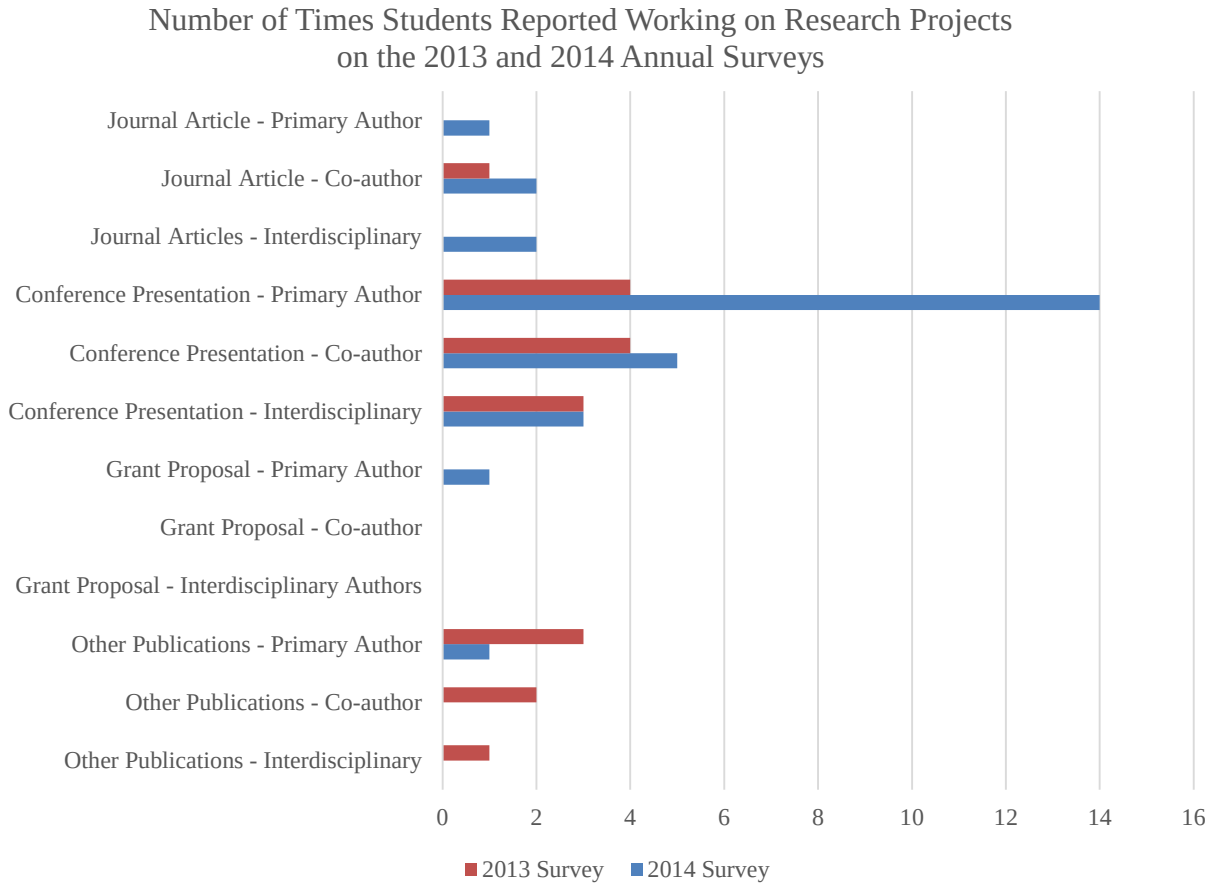


Figure 4. Number of times students reported working on research projects in 2013 and 2014 annual surveys. (2013 n = 14, 2014 n = 14). Book chapters, books, patent applications, and approved patents are not included in the figure since no students reported any of those types of publications in either the 2013 survey or the 2014 survey.

Table 7 addresses conferences and workshops that WESEP IGERT students attended and/or presented at. One 2012 cohort student reported attending a conference/workshop at ISU and presenting a poster. Two 2012 students reported attending a conference outside of ISU but within the U.S., and one of these students presented a poster. Three 2012 students attended an international conference/workshop, one of whom presented a paper at the event. 2013 cohort students reported the highest level of attendance and making presentations, with five students attending a conference/workshop at ISU, four of whom presented posters. In addition, six 2013 students attended a conference/workshop within the U.S., – five of these students presented posters, and two presented papers. Two 2013 students attended a conference/workshop outside of the U.S., with one student having presented a paper. One 2014 student reported attending a conference within the U.S. No 2014 students have yet attended a conference/workshop at ISU or internationally and none have presented either an oral talk or a poster. As shown in Figure 5, student conference attendance and presentation rates remained similar from the time of the 2013 survey to the time of the 2014 survey, although international conference attendance and presentations

have increased, with no students having reported attending a conference held outside the US in the 2013 survey.

**Table 7: Conferences and Workshops Attended**

| | Attended a conference n | Attended a conference % | Presented a poster n | Presented a poster % | Presented a paper n | Presented a paper % |
|---|---|---|---|---|---|---|
| At home institution | | | | | | |
| 2012 Cohort | 1 | 25.0 | 1 | 25.0 | 0 | 0.0 |
| 2013 Cohort | 5 | 62.5 | 4 | 50.0 | 0 | 0.0 |
| 2014 Cohort | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Within the U.S. (outside the home institution) | | | | | | |
| 2012 Cohort | 2 | 50.0 | 1 | 25.0 | 0 | 0.0 |
| 2013 Cohort | 6 | 75.0 | 5 | 62.5 | 2 | 25.0 |
| 2014 Cohort | 1 | 50.0 | 0 | 0.0 | 0 | 0.0 |
| Outside the U.S. | | | | | | |
| 2012 Cohort | 3 | 75.0 | 0 | 0.0 | 1 | 25.0 |
| 2013 Cohort | 2 | 25.0 | 0 | 0.0 | 1 | 12.5 |
| 2014 Cohort | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |

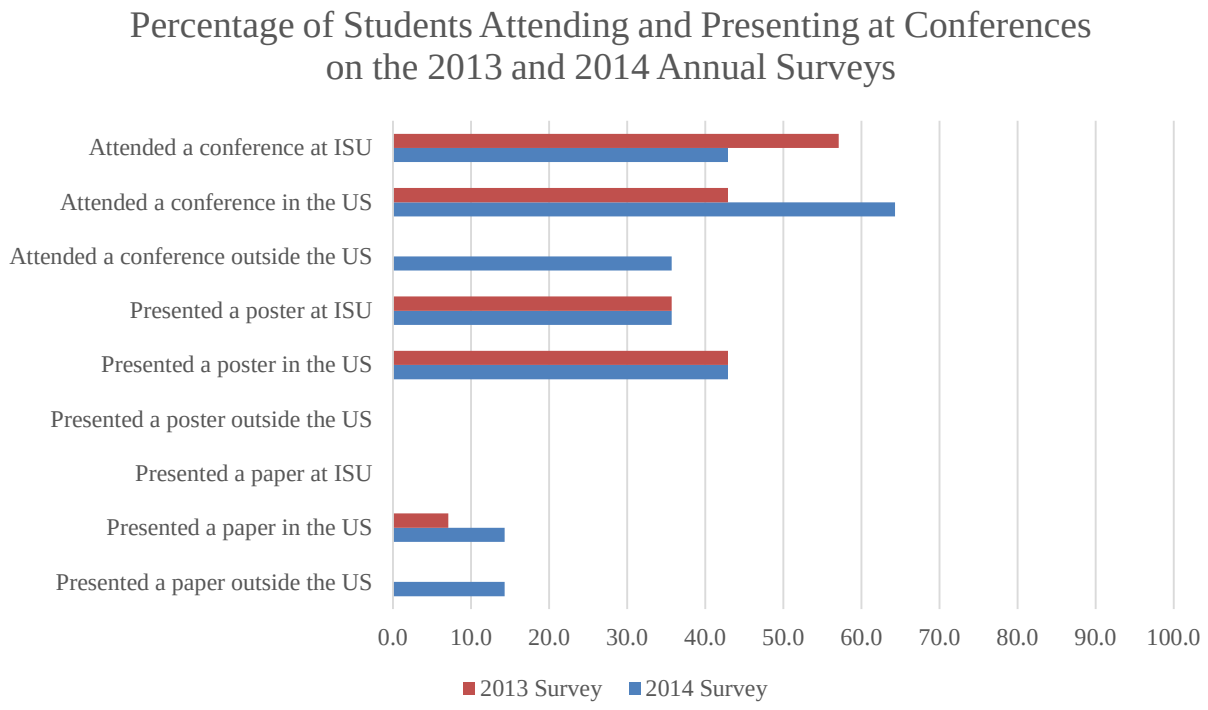


Figure 5. Percentage of students attending and presenting at conferences in the 2013 and 2014 annual surveys. (2013 n = 14, 2014 n = 14).

2012 and 2013 cohort students were asked about the usefulness of WESEP 594: the RTRCs. Of note, 2014 students indicated that they had limited experience with the RTRC so their responses were not included (Table 8). On average, students indicated that the RTRC was "somewhat useful," reporting that it was most useful for enhancing their awareness of and ability to respond to ethical issues. Students reported, on average, that the RTRC was least useful for making industry connections, with students rating the RTRC only slightly higher in its usefulness for stimulating and enhancing students' research productivity. As shown in Figure 6, students rated WESEP 594 similarly in the 2013 and 2014 annual surveys. Students did rate the RTRC much more highly in 2014 regarding its usefulness in enhancing their awareness of and ability to respond to ethical issues.

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

| | Not at all Useful | A Little Useful | Somewhat Useful | Very Useful | n | Mean | s.d. |
|---|---|---|---|---|---|---|---|
| Learning how to do research | | | | | | | |
| 2012 Cohort | 0 | 3 | 0 | 1 | 4 | 2.50 | 1.000 |
| 2013 Cohort | 0 | 1 | 5 | 1 | 7 | 3.00 | 0.577 |
| Stimulating and enhancing your research productivity | | | | | | | |
| 2012 Cohort | 0 | 1 | 2 | 1 | 4 | 3.00 | 0.816 |
| 2013 Cohort | 2 | 1 | 3 | 1 | 7 | 2.43 | 1.134 |
| Facilitating your interdisciplinary work | | | | | | | |
| 2012 Cohort | 0 | 1 | 2 | 1 | 4 | 3.00 | 0.816 |
| 2013 Cohort | 0 | 4 | 2 | 1 | 7 | 2.57 | 0.787 |
| Enhancing your communication skills | | | | | | | |
| 2012 Cohort | 0 | 1 | 3 | 0 | 4 | 2.75 | 0.500 |
| 2013 Cohort | 0 | 1 | 3 | 3 | 7 | 3.29 | 0.756 |
| Enhancing your awareness of and ability to respond to ethical issues | | | | | | | |
| 2012 Cohort | 0 | 1 | 2 | 1 | 4 | 3.00 | 0.816 |
| 2013 Cohort | 0 | 0 | 4 | 3 | 7 | 3.43 | 0.535 |
| Learning about environmental and policy issues | | | | | | | |
| 2012 Cohort | 0 | 1 | 1 | 2 | 4 | 3.25 | 0.957 |
| 2013 Cohort | 2 | 0 | 5 | 0 | 7 | 2.43 | 0.976 |
| Making industry connections | | | | | | | |
| 2012 Cohort | 1 | 1 | 0 | 2 | 4 | 2.75 | 1.500 |
| 2013 Cohort | 1 | 3 | 3 | 0 | 7 | 2.29 | 0.756 |

Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful
2014 cohort students were not included in this table due to limited exposure to the RTRC.

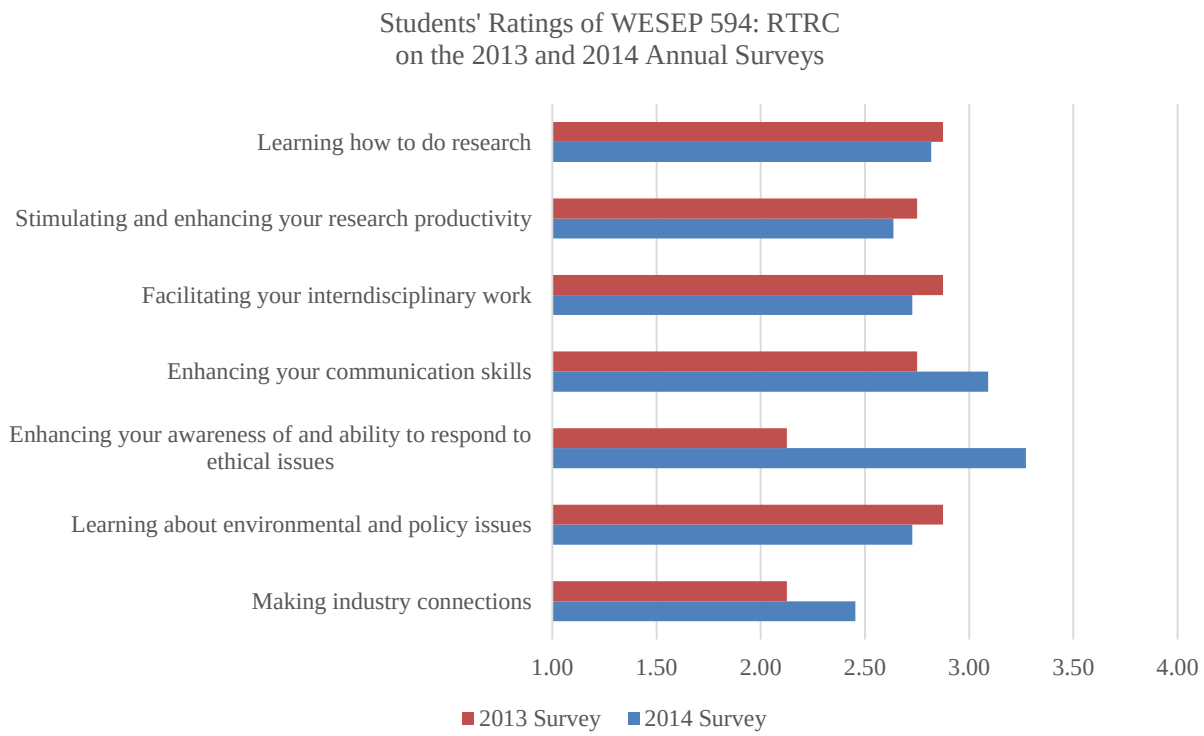


Figure 6. Students' ratings of WESEP 594: RTRC in the 2013 and 2014 annual surveys. (2013 n = 8, 2014 n = 11). Students entering the program the fall semester that the survey was administered are not included in this table due to their limited exposure to the WESEP 594 at the time of the survey. Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful.

### 2.1.3 Student Learning, Preparation, and Suggestions for Improvement

Students were asked two closed-ended response items related to their perceptions of their individual preparedness and the opportunities provided by their graduate program. Students were also asked to provide suggestions for improving the IGERT program.

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, indicating that they were at least somewhat prepared in each area. On average, students felt most prepared to conduct research in an ethnical manner, to understand and work in an academic setting, and to work in research teams within their discipline. Students, on average, reported that they were least prepared to write research articles or books. As would be expected, 2014 cohort students rated themselves as less prepared than 2012 and 2013 students in most of the areas listed. 2012 and 2013 cohort students tended to rate their levels of preparedness similarly, with the exception that 2012 students rated themselves an entire scale point higher than either of the other two cohorts on their preparedness to work outside of academia.

**Table 9: Students' Perceptions of Preparedness**

| | Not Prepared | A Little Prepared | Somewhat Prepared | Mostly Prepared | Very Prepared | n | Mean | s.d. |
|---|---|---|---|---|---|---|---|---|
| Conduct high-quality research | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 2 | 1 | 4 | 4.00 | 0.816 |
| 2013 Cohort | 0 | 0 | 2 | 3 | 3 | 8 | 4.13 | 0.835 |
| 2014 Cohort | 0 | 0 | 2 | 0 | 0 | 2 | 3.00 | -- |
| Communicate with people inside your field | | | | | | | | |
| 2012 Cohort | 0 | 0 | 2 | 1 | 1 | 4 | 3.75 | 0.957 |
| 2013 Cohort | 0 | 0 | 2 | 4 | 2 | 8 | 4.00 | 0.756 |
| 2014 Cohort | 0 | 1 | 0 | 1 | 0 | 2 | 3.00 | -- |
| Understand and work in an academic setting | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 2 | 1 | 4 | 4.00 | 0.816 |
| 2013 Cohort | 0 | 0 | 1 | 4 | 3 | 8 | 4.25 | 0.707 |
| 2014 Cohort | 0 | 0 | 0 | 1 | 1 | 2 | 4.50 | -- |
| Conduct research in an ethical manner | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 0 | 3 | 4 | 4.50 | 1.000 |
| 2013 Cohort | 0 | 0 | 0 | 4 | 4 | 8 | 4.50 | 0.535 |
| 2014 Cohort | 0 | 0 | 0 | 2 | 0 | 2 | 4.00 | -- |
| Present research findings to scientific peers | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 3 | 0 | 4 | 3.75 | 0.500 |
| 2013 Cohort | 0 | 0 | 1 | 5 | 2 | 8 | 4.13 | 0.641 |
| 2014 Cohort | 1 | 0 | 0 | 1 | 0 | 2 | 2.50 | -- |
| Know your discipline in depth | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 3 | 0 | 4 | 3.75 | 0.500 |
| 2013 Cohort | 0 | 0 | 1 | 6 | 1 | 8 | 4.00 | 0.535 |
| 2014 Cohort | 1 | 0 | 1 | 0 | 0 | 2 | 2.00 | -- |

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

**Table 9: Students' Perceptions of Preparedness (con't)**

| | Not Prepared | A Little Prepared | Somewhat Prepared | Mostly Prepared | Very Prepared | n | Mean | s.d. |
|---|---|---|---|---|---|---|---|---|
| Work in teams of researchers from more than one discipline | | | | | | | | |
| 2012 Cohort | 0 | 0 | 0 | 3 | 1 | 4 | 4.25 | 0.500 |
| 2013 Cohort | 0 | 1 | 0 | 7 | 0 | 8 | 3.75 | 0.707 |
| 2014 Cohort | 0 | 0 | 1 | 1 | 0 | 2 | 3.50 | -- |
| Work in research teams within your discipline | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 1 | 2 | 4 | 4.25 | 0.957 |
| 2013 Cohort | 0 | 0 | 0 | 4 | 4 | 8 | 4.50 | 0.535 |
| 2014 Cohort | 0 | 1 | 1 | 0 | 0 | 2 | 2.50 | -- |
| Collaborate with international scientists | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 1 | 2 | 4 | 4.25 | 0.957 |
| 2013 Cohort | 0 | 1 | 1 | 4 | 2 | 8 | 3.88 | 0.991 |
| 2014 Cohort | 0 | 1 | 0 | 1 | 0 | 2 | 3.00 | -- |
| Write research articles or books | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 3 | 0 | 4 | 3.75 | 0.500 |
| 2013 Cohort | 1 | 0 | 2 | 4 | 1 | 8 | 3.50 | 1.195 |
| 2014 Cohort | 0 | 2 | 0 | 0 | 0 | 2 | 2.00 | -- |
| Communicate with people outside your field | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 3 | 0 | 4 | 3.75 | 0.500 |
| 2013 Cohort | 0 | 0 | 3 | 5 | 0 | 8 | 3.63 | 0.518 |
| 2014 Cohort | 0 | 0 | 1 | 1 | 0 | 2 | 3.50 | -- |
| Communicate research findings to the general public | | | | | | | | |
| 2012 Cohort | 0 | 0 | 2 | 1 | 1 | 4 | 3.75 | 0.957 |
| 2013 Cohort | 0 | 1 | 4 | 3 | 0 | 8 | 3.25 | 0.707 |
| 2014 Cohort | 0 | 1 | 0 | 0 | 1 | 2 | 3.50 | -- |

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

**Table 9: Students' Perceptions of Preparedness (con't)**

| | Not Prepared | A Little Prepared | Somewhat Prepared | Mostly Prepared | Very Prepared | n | Mean | s.d. |
|---|---|---|---|---|---|---|---|---|
| Work outside of academia (industry, public sector) | | | | | | | | |
| 2012 Cohort | 0 | 0 | 0 | 2 | 2 | 4 | 4.50 | 0.577 |
| 2013 Cohort | 0 | 2 | 2 | 4 | 0 | 8 | 3.25 | 0.886 |
| 2014 Cohort | 0 | 0 | 1 | 1 | 0 | 2 | 3.50 | -- |

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

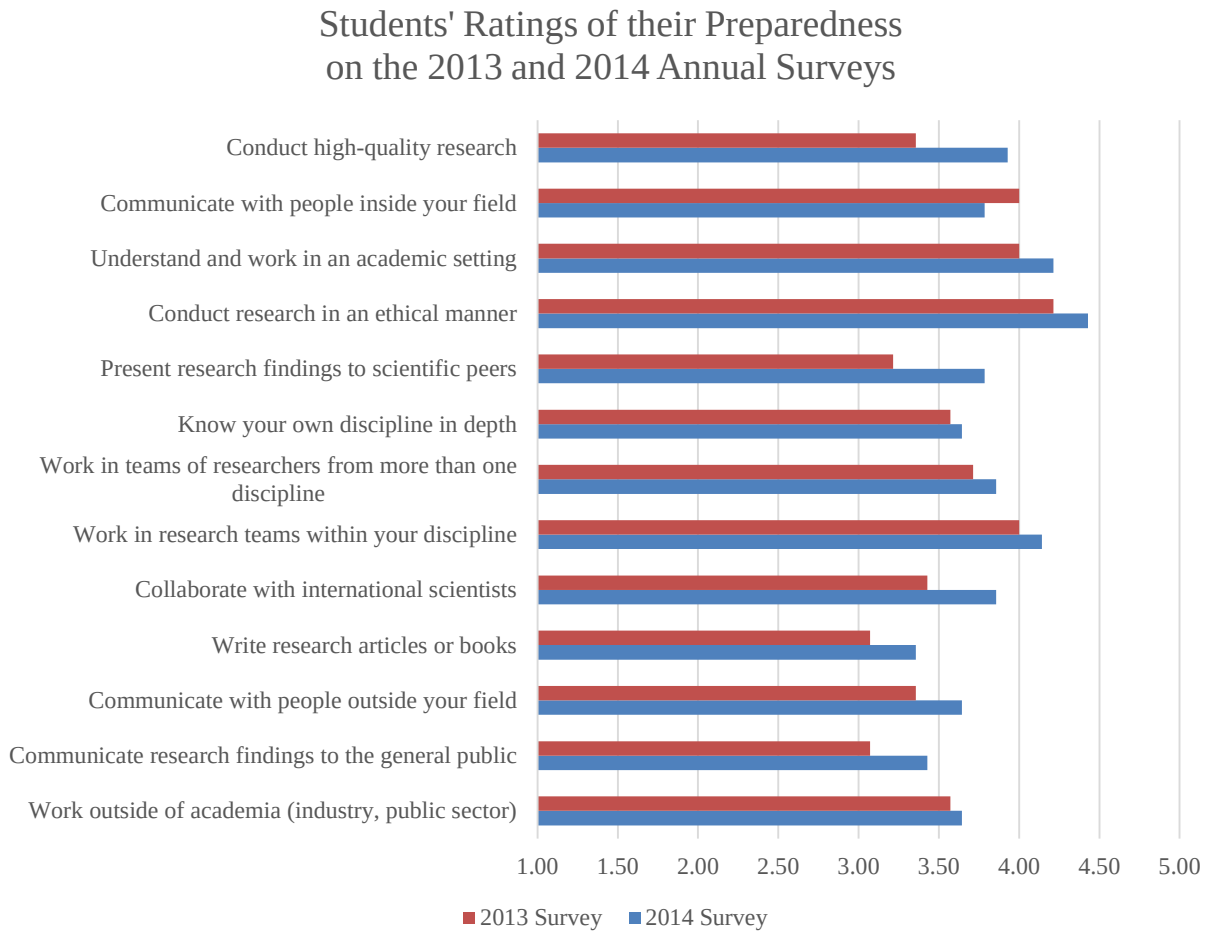


Figure 7. Students' ratings of their preparedness in the 2013 and 2014 annual surveys. (2013 n = 14, 2014 n = 14). Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared.

In Table 10 students' perceptions of the IGERT WESEP program are presented. Overall, the majority of students tended to agree with each of the items presented. Students agreed most strongly that they experienced high demands on their time from their academic program, with all but one student reporting that they agreed or strongly agreed to this item (one student in the 2013 cohort neither agreed nor disagreed). The next most highly rated item overall indicated that students felt like they were able to study their field in as much depth as they like, with all but one student agreeing or strongly agreeing to this item (one 2014 cohort student neither agreed nor disagreed). Students also indicated that they felt like they were a part of a strong student community – all of the 2012 and 2013 cohort students agreed or strongly agreed to this item, while both of the 2014 students indicated that they neither agreed nor disagreed. Overall, students also agreed that they had developed the ability to communicate and work on research problems with researchers from more than one discipline, with all but two students agreeing or strongly agreeing to this item and the remaining two students indicated that they neither agreed nor disagreed. The overall lowest rated item asked students whether they felt they had been prepared to conduct research outside their institution. Three students neither agreed nor disagreed to this item, and three students disagreed. Notably, the 2012 cohort students all agreed or strongly agreed that they were being prepared to conduct research outside of their

institution, suggesting that this may be training that students are receiving later in their programs. As shown in Figure 8, students responded similarly to these items on the 2013 and 2014 annual surveys, with students rating most items slightly higher on the 2014 survey. On the 2014 survey, students agreed much more strongly that they felt like part of a strong student community.

**Table 10: Students' Perceptions of their Graduate Program**

| | Strongly Disagree | Disagree | Neither Agree nor Disagree | Agree | Strongly Agree | n | Mean | s.d. |
|---|---|---|---|---|---|---|---|---|
| I am able to study my field in as much depth as I like. | | | | | | | | |
| 2012 Cohort | 0 | 0 | 0 | 2 | 2 | 4 | 4.50 | 0.577 |
| 2013 Cohort | 0 | 0 | 0 | 4 | 4 | 8 | 4.50 | 0.535 |
| 2014 Cohort | 0 | 0 | 1 | 0 | 1 | 2 | 4.00 | -- |
| I have developed the ability to communicate and work on research problems with researchers from more than one discipline. | | | | | | | | |
| 2012 Cohort | 0 | 0 | 0 | 3 | 1 | 4 | 4.25 | 0.500 |
| 2013 Cohort | 0 | 0 | 1 | 6 | 1 | 8 | 4.00 | 0.535 |
| 2014 Cohort | 0 | 0 | 1 | 1 | 0 | 2 | 3.50 | -- |
| I experience high demands on my time from my academic program. | | | | | | | | |
| 2012 Cohort | 0 | 0 | 0 | 2 | 2 | 4 | 4.50 | 0.577 |
| 2013 Cohort | 0 | 0 | 1 | 0 | 7 | 8 | 4.75 | 0.707 |
| 2014 Cohort | 0 | 0 | 0 | 1 | 1 | 2 | 4.50 | -- |
| I receive adequate opportunities to network with researchers outside this university. | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 1 | 2 | 4 | 4.25 | 0.957 |
| 2013 Cohort | 0 | 2 | 2 | 3 | 1 | 8 | 3.38 | 1.061 |
| 2014 Cohort | 0 | 0 | 1 | 0 | 1 | 2 | 4.00 | -- |
| I am familiar with current research being conducted in my field in foreign countries. | | | | | | | | |
| 2012 Cohort | 0 | 1 | 0 | 2 | 1 | 4 | 3.75 | 1.258 |
| 2013 Cohort | 0 | 1 | 0 | 6 | 1 | 8 | 3.88 | 0.835 |
| 2014 Cohort | 0 | 1 | 0 | 0 | 1 | 2 | 3.50 | -- |

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

**Table 10: Students' Perceptions of their Graduate Program (con't)**

| | Strongly Disagree | Disagree | Neither Agree nor Disagree | Agree | Strongly Agree | n | Mean | s.d. |
|---|---|---|---|---|---|---|---|---|
| I have been prepared to conduct research outside my institution. | | | | | | | | |
| 2012 Cohort | 0 | 0 | 0 | 1 | 3 | 4 | 4.75 | 0.500 |
| 2013 Cohort | 0 | 3 | 1 | 4 | 0 | 8 | 3.13 | 0.991 |
| 2014 Cohort | 0 | 0 | 2 | 0 | 0 | 2 | 3.00 | -- |
| I am being prepared for a wide range of career possibilities. | | | | | | | | |
| 2012 Cohort | 0 | 0 | 1 | 1 | 2 | 4 | 4.25 | 0.957 |
| 2013 Cohort | 0 | 0 | 2 | 6 | 0 | 8 | 3.75 | 0.463 |
| 2014 Cohort | 0 | 0 | 1 | 1 | 0 | 2 | 3.50 | -- |
| I am part of a strong student community. | | | | | | | | |
| 2012 Cohort | 0 | 0 | 0 | 2 | 2 | 4 | 4.50 | 0.577 |
| 2013 Cohort | 0 | 0 | 0 | 3 | 5 | 8 | 4.63 | 0.518 |
| 2014 Cohort | 0 | 0 | 2 | 0 | 0 | 2 | 3.00 | -- |

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

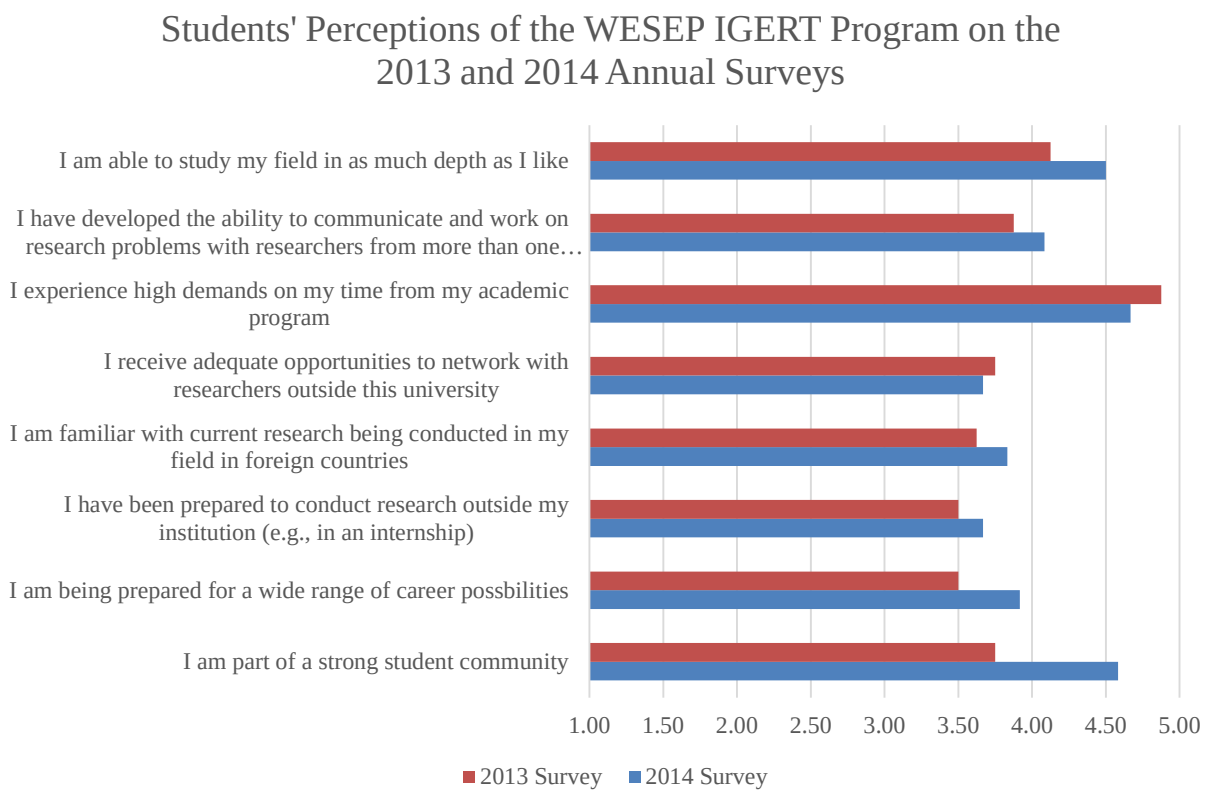


Figure 8. Students' perceptions of the WESEP IGERT program in the 2013 and 2014 annual surveys. (2013 n = 8, 2014 n = 12). For consistency, neither group of incoming students into the program were included in this chart (In the 2013 annual survey, incoming students were not asked to respond to this question. In the 2014 survey, 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.

### 2.1.4 Student Written Responses in the Student Survey

**What suggestions do you have to improve the IGERT program?**

- WESEP 594 needs a revamp. I really like when we have outside speakers and faculty present. However, I think the format in which students are presenting their own research is a waste of time and effort. I understand the benefit of students knowing what each other are researching, but I think it could be done in a better way.
- So far I really have no recommendations (as lame as that is). But in general the IGERT program is providing a great opportunity for myself and other fellow PhD researchers to work in a productive manner.
- We have had many useful industry presenters as part of the seminar WESEP 594, Real-Time Research Collaborative. I feel that gaining different industry perspectives regarding wind energy has been very useful and I do not want to propose to change that. What I feel could add significant benefit to this seminar is to have a presenter talk about his or her own transition from academia to industry.
- A stronger national community to encourage collaboration between students from different universities.

- I know that this is a multidisciplinary program, but in my opinion, we are taking way too many courses not directly related to our own specific fields of study/research. This is a major problem because the more unrelated courses we take, the less we will know about our own majors, and also the less time we will have to do any research, and consequently, delays our graduation. Hence, I was hoping if we could reduce the number of courses required for this major and instead make the focus of this PhD program on doing research on wind energy topics.
- Increased communication with major professors would be helpful. My major professor, for example, claims he is told very little of the expectations for WESEP students and, as a result, doesn't know whether he should be treating me the same way he would treat one of his other research students or if there are different goals/procedures. This communication is mostly left up to me and, as a first year student, I'm not always completely confident I know what to communicate.
- I would like to see more community/outreach programs. I think this is something the students should organize.
- To date there does not appear to be a strong connection with external industry or government partners. Students who have obtained internships have done so on their own and not through existing connections between WESEP and external collaborators. One example is that I am not aware of a great deal of collaboration with NREL, which would seem otherwise to be a strong potential partner.
- Enhance education/training related to communication skills (personal and electronic).

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

- For WESEP 594, I was hoping if we could eliminate the student presentations and instead bring more industry/government/or academic representatives in the field of wind energy/engineering/design/policy/marketing and etc. to help us better understand the difficulties and major issues that these experienced organizations are facing here in the U.S. or even in Europe. Student presentations can be beneficial to the students themselves, but only if the audience had the same background as the student presenter him/herself. So in my opinion, the student presentations will not be beneficial in the multi-background groups such as our WESEP program. There were none.
- I have not participated in a RTRC so my feedback for that section has zero ground. Additionally, I feel that, because I have only been a part of this program for a short time, my responses only somewhat represent the WESEP program.
- Excellent program!

## 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 and Publications; 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 2013 inviting them to complete the faculty survey. Of these 25 faculty, 18 responded to the survey. Not all faculty members responded to every question.

### 2.2.1 Overview

Faculty participation in the IGERT program is presented in Table 11. Nearly three quarters of the faculty reported that they advised IGERT graduate students, and half of the faculty indicated that they conducted IGERT-related research. Forty-four percent of faculty indicated that they taught IGERT courses, 39% served on IGERT dissertation committees, and 28% indicated that IGERT graduate students worked in their labs. Less than a quarter of faculty reportedly attended IGERT workshops or lectures (22.2%) or contributed to IGERT project management (16.7%). One faculty respondent reportedly assisted with workshops.

**Table 11: Participation in the IGERT Project**

| | n | % |
|---|---|---|
| I advise IGERT graduate students | 13 | 72.2 |
| I serve on IGERT dissertation committees | 7 | 38.9 |
| I conduct IGERT-related research | 9 | 50.0 |
| I attend IGERT workshops or lectures | 4 | 22.2 |
| IGERT graduate students work in my lab | 5 | 27.8 |
| I teach IGERT courses | 8 | 44.4 |
| I contribute to IGERT project management | 3 | 16.7 |
| Other[a] | 1 | 5.6 |

### 2.2.2 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 12. On peer-reviewed journal articles related to WESEP, faculty reportedly served as a primary author six times, a co-author 15 times, and worked with an interdisciplinary author/co-author 11 times. On conference presentations or posters related to WESEP, faculty reportedly served as primary author four times, co-author 28 times, and worked with an interdisciplinary author/co-author 22 times. Faculty additionally reported serving as a primary author on a book chapter twice, and a coauthor on a book chapter twice. One faculty member was the primary author on a patent application. On grant applications, faculty served as a primary author 12 times, a coauthor four times, and worked with an interdisciplinary author twice.

As shown in Figure 9, faculty research outputs increased in most areas from the time of the 2013 survey to the time of the 2014 survey. Faculty did report a decrease in the number of times that they had served as a primary author on a WESEP conference presentation in the last year, however, the number of times that they reported serving as a co-author on a WESEP conference presentation more than tripled, and they nearly tripled the number of times that they had worked with an interdisciplinary author on a conference presentation. Faculty also tripled the number of times they reported serving as a primary author on a journal article, increased the number of times that they had served as a co-author on a journal article, and more than doubled the number of times they reported working with an interdisciplinary author on a journal article. No faculty in the 2013 survey reported working on a book chapter, but faculty reported serving as a primary author on a book chapter twice and a co-author on a book chapter twice in the 2014 survey. Notably, faculty also tripled the number of times they served as a primary author on a grant proposal, and doubled the number of times they served as a co-author or worked with an interdisciplinary author on a grant proposal. One faculty in 2013, but none in 2014, reported having a patent approved, though one faculty in 2014, but none in 2013, had completed a patent application.

**Table 12: Faculty, Publications and Other Scholarly Activity Related to WESEP**

| | n | Mean | s.d. |
|---|---|---|---|
| Journal articles in refereed journals | | | |
| Primary Author | 6 | 0.33 | 0.686 |
| Co-author | 15 | 0.83 | 1.200 |
| Interdisciplinary author/co-authors | 11 | 0.61 | 1.378 |
| Conference paper or poster presentations | | | |
| Primary Author | 4 | 0.22 | 0.548 |
| Co-author | 28 | 1.56 | 2.064 |
| Interdisciplinary author/co-authors | 22 | 1.22 | 2.016 |
| Book chapters | | | |
| Primary Author | 2 | 0.11 | 0.323 |
| Co-author | 2 | 0.11 | 0.323 |
| Interdisciplinary author/co-authors | 0 | 0.00 | 0.000 |
| Books | | | |
| Primary Author | 0 | 0.00 | 0.000 |
| Co-author | 0 | 0.00 | 0.000 |
| Interdisciplinary author/co-authors | 0 | 0.00 | 0.000 |
| Patent applications | | | |
| Primary Author | 1 | 0.06 | 0.236 |
| Co-author | 0 | 0.00 | 0.000 |
| Interdisciplinary author/co-authors | 0 | 0.00 | 0.000 |
| Approved patents | | | |
| Primary Author | 0 | 0.00 | 0.000 |
| Co-author | 0 | 0.00 | 0.000 |
| Interdisciplinary author/co-authors | 0 | 0.00 | 0.000 |
| Grant proposals | | | |
| Primary Author | 12 | 0.67 | 1.879 |
| Co-author | 4 | 0.22 | 0.548 |
| Interdisciplinary author/co-authors | 2 | 0.11 | 0.323 |
| All other publications | | | |
| Primary Author | 0 | 0.00 | 0.000 |
| Co-author | 0 | 0.00 | 0.000 |
| Interdisciplinary author/co-authors | 0 | 0.00 | 0.000 |

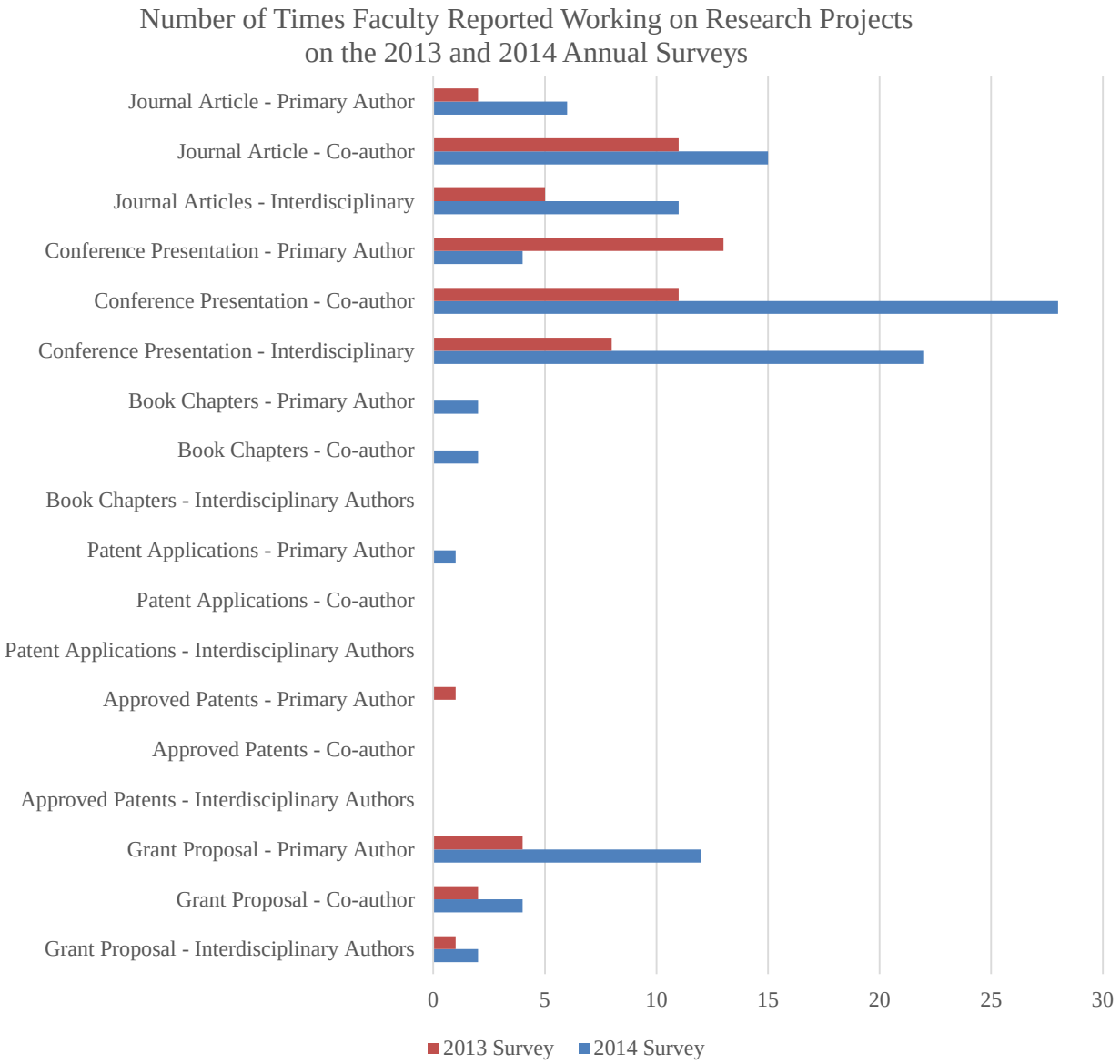


Figure 9. Number of times faculty reported working on research projects in 2013 and 2014 annual surveys. (2013 n = 17, 2014 n = 18). Books and other publications are not included in the figure since no faculty members reported any of those types of publications in either the 2013 survey or the 2014 survey.

As shown in Table 13, 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. Nine of the 18 faculty respondents indicated that they had presented research findings at a conference outside their home discipline, and eight faculty 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 stable from the time of the 2013 annual survey to the time of the 2014 annual survey (Figure 10).

**Table 13: Research Publications and Professional Conference Talks/Posters Outside of the Faculty Home Discipline**

| | n | % |
|---|---|---|
| Published research findings in a journal outside your home discipline. | 8 | 44.4 |
| Presented research findings at a conference outside your home discipline. | 9 | 50.0 |

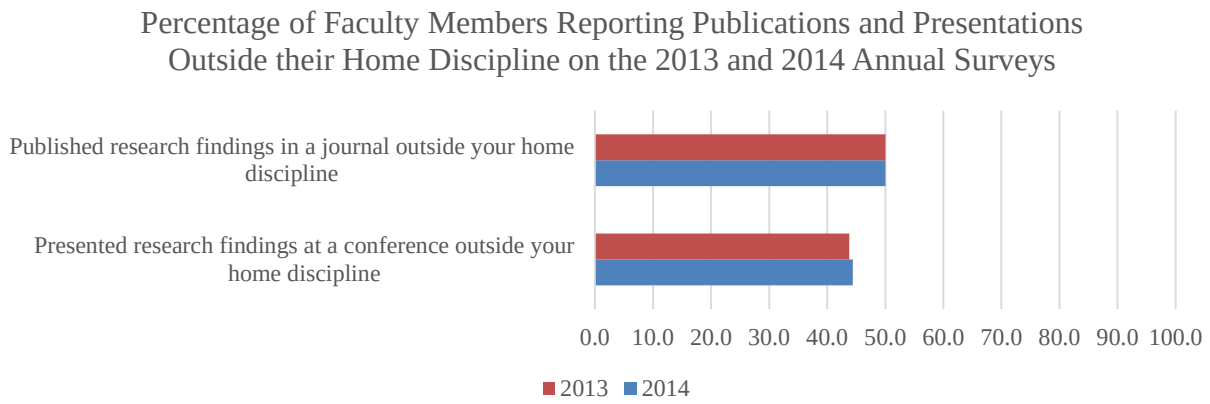


Figure 10. Percentage of faculty members reporting publications and presentations outside their home discipline on the 2013 and 2014 annual surveys (2013 n = 16, 2014 n = 18).

### 2.2.3 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?**

Seven faculty responded to this question. Faculty responses were varied and indicated that a variety of techniques were used to attract applicants. However, the majority of faculty did not seem to feel personally involved in the recruitment process. Faculty responses are listed below.

- Approaching on a personal basis.
- I believe advertising was fairly extensive.
- Outreach to 4 year college physics departments, running WESEP REU program.
- Dr. McCalley has made visits to the best engineering school in the nation that does not have a PhD program (Rose Hulman) and given a seminar on wind energy. The IGERT program administrative assistant (Barb Brown) has contacted many other universities

around the nation to disseminate information on the IGERT program. Many of the IGERT fellows have made trips to other universities to advertise the IGERT program. We have mailed an IGERT flyer to the student services manager of every engineering school in the nation. We have sent the IGERT flyer to all IGERT faculty and asked them to send it to at least five colleagues at other universities. We have sent the flyer to a large number of minority institutions around the country. Dr. McCalley has attended two women-in-engineering gatherings and disseminated the IGERT flyer at IEEE professional meetings.

- Program's reputation.
- Others did the recruitment. Biggest issue I have is that getting engaged by IGERT core team is a challenge. Seem to be continually not getting information that I need to manage student (who seems to be particularly bad at keeping me in the loop). I should not have to rely on him to get me information.
- IGERT program is widely publicized.

### 2.2.4. Impact of IGERT on Faculty Home Departments

WESEP faculty were asked to respond to a series of questions on the impact of IGERT on their home department admissions; as shown in Table 14. Faculty agreed most strongly that they have attracted more students who are U.S. citizens, with eight faculty agreeing to this item and two faculty disagreeing. Six faculty agreed that they had attracted more students to their department, six agreed that they had attracted students with different career goals, and five faculty agreed that they had attracted better qualified students (2-4 faculty members disagreed with each of these items). Of the items listed, faculty agreed least that the WESEP IGERT program had helped them to attract international students to their home departments, with six faculty disagreeing and no faculty agreeing to this item.

As shown in Figure 11, faculty members agreed slightly less on each item related to the impact of IGERT on departmental missions on the 2014 annual survey than they did on the 2013 annual survey. The differences between the two surveys are not statistically significant.

**Table 14: 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 | 1 | 1 | 8 | 5 | 0 | 15 | 3.13 | 0.834 |
| We have attracted more students | 1 | 3 | 5 | 6 | 0 | 15 | 3.07 | 0.961 |
| We have attracted more students who are U.S. citizens | 1 | 1 | 5 | 7 | 1 | 15 | 3.40 | 0.986 |
| We have attracted students who have inter/multidisciplinary backgrounds | 1 | 2 | 8 | 4 | 0 | 15 | 3.00 | 0.845 |
| We have experienced increased admissions inquiries into our program | 1 | 2 | 10 | 2 | 0 | 15 | 2.87 | 0.743 |
| We have attracted students from a collectively more varied disciplinary background | 2 | 0 | 9 | 4 | 0 | 15 | 3.00 | 0.926 |
| We have attracted students with different career goals | 2 | 0 | 7 | 6 | 0 | 15 | 3.13 | 0.990 |
| We have attracted more underrepresented minority students | 3 | 3 | 8 | 1 | 0 | 15 | 2.47 | 0.915 |
| We have attracted more female students | 3 | 0 | 8 | 4 | 0 | 15 | 2.87 | 1.060 |
| We have attracted more international students | 4 | 2 | 9 | 0 | 0 | 15 | 2.33 | 0.900 |

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

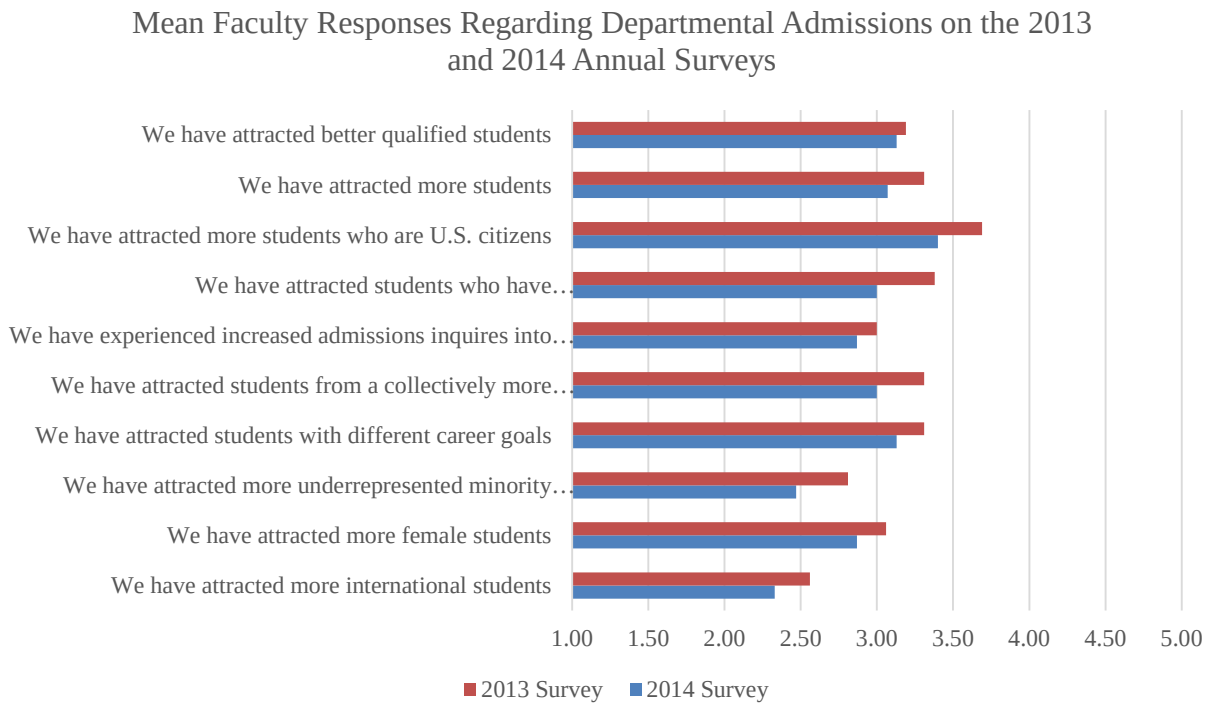


Figure 11. Mean faculty responses regarding departmental admissions on the 2013 and 2014 annual surveys (2013 n = 16, 2014 n = 15). Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree.

### 2.2.5 Comparison of IGERT to Non-IGERT students

IGERT faculty were asked to compare IGERT and Non-IGERT graduate students in their respective home departments, as detailed in the responses in Table 15. Notably, on average the IGERT students were rated as being better prepared than their Non-IGERT peers on all but one item. IGERT students were rated slightly lower overall in their knowledge of their own discipline. IGERT students were rated the highest in their preparedness to understand and work in an academic setting and conduct research in an ethnical manner. The disparity between the ratings received by IGERT and non-IGERT students was nearly a full point on items related to preparedness to communicate with people outside of their field, work in teams of researchers from more than one discipline, and collaborate with international scientists. Additionally, disparities between the ratings received by IGERT and non-IGERT students exceeded half a point, on average, for four items: preparedness to work in research teams within their disciplines, preparedness to write research articles or books, preparedness to work outside of academia, and preparedness to communicate research findings to the general public.

As shown in Figure 12, faculty tended to rate IGERT students higher than Non-IGERT students on both the 2013 and 2014 surveys. Faculty did tend to rate IGERT students as slightly more prepared on the 2013 survey than they did on the 2014 survey.

**Table 15: 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 | 2 | 2 | 2 | 7 | 2 | 13 | 4.08 | 1.188 |
| Non-IGERT Graduate Students | 0 | 0 | 3 | 9 | 4 | 0 | 16 | 4.06 | 0.680 |
| Present research findings to scientific peers | | | | | | | | | |
| IGERT Graduate Students | 0 | 2 | 2 | 2 | 7 | 2 | 13 | 4.08 | 1.188 |
| Non-IGERT Graduate Students | 0 | 1 | 4 | 9 | 2 | 0 | 16 | 3.75 | 0.775 |
| Know their own discipline in depth | | | | | | | | | |
| IGERT Graduate Students | 0 | 2 | 2 | 2 | 7 | 2 | 13 | 4.08 | 1.188 |
| Non-IGERT Graduate Students | 0 | 0 | 1 | 10 | 5 | 0 | 16 | 4.25 | 0.577 |
| Communicate with people inside their field | | | | | | | | | |
| IGERT Graduate Students | 0 | 1 | 2 | 4 | 4 | 4 | 11 | 4.00 | 1.000 |
| Non-IGERT Graduate Students | 0 | 0 | 6 | 6 | 4 | 0 | 16 | 3.88 | 0.806 |
| Work in research teams within their discipline | | | | | | | | | |
| IGERT Graduate Students | 0 | 0 | 1 | 6 | 5 | 3 | 12 | 4.33 | 0.651 |
| Non-IGERT Graduate Students | 0 | 0 | 4 | 11 | 1 | 0 | 16 | 3.81 | 0.544 |
| Understand and work in an academic setting | | | | | | | | | |
| IGERT Graduate Students | 0 | 0 | 2 | 3 | 8 | 2 | 13 | 4.46 | 0.776 |
| Non-IGERT Graduate Students | 0 | 0 | 3 | 8 | 5 | 0 | 16 | 4.13 | 0.719 |
| Write research articles or books | | | | | | | | | |
| IGERT Graduate Students | 0 | 1 | 1 | 6 | 4 | 3 | 12 | 4.08 | 0.900 |
| Non-IGERT Graduate Students | 1 | 0 | 5 | 9 | 1 | 0 | 16 | 3.56 | 0.892 |
| Conduct research in an ethical manner | | | | | | | | | |
| IGERT Graduate Students | 0 | 0 | 2 | 3 | 8 | 3 | 13 | 4.46 | 0.776 |
| Non-IGERT Graduate Students | 0 | 0 | 4 | 7 | 5 | 0 | 16 | 4.06 | 0.772 |
| Communicate with people outside their field | | | | | | | | | |
| IGERT Graduate Students | 0 | 1 | 2 | 3 | 6 | 3 | 12 | 4.17 | 1.030 |
| Non-IGERT Graduate Students | 0 | 4 | 6 | 5 | 1 | 0 | 16 | 3.19 | 0.911 |

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 15: 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 | 1 | 2 | 6 | 5 | 1 | 14 | 4.07 | 0.917 |
| Non-IGERT Graduate Students | 0 | 5 | 4 | 6 | 1 | 0 | 16 | 3.19 | 0.981 |
| Work outside of academia, (industry, public sector) | | | | | | | | | |
| IGERT Graduate Students | 0 | 1 | 1 | 7 | 2 | 4 | 11 | 3.91 | 0.831 |
| Non-IGERT Graduate Students | 1 | 3 | 4 | 7 | 1 | 0 | 16 | 3.25 | 1.065 |
| Collaborate with international scientists | | | | | | | | | |
| IGERT Graduate Students | 0 | 0 | 4 | 6 | 2 | 3 | 12 | 3.83 | 0.718 |
| Non-IGERT Graduate Students | 2 | 4 | 5 | 4 | 1 | 0 | 16 | 2.88 | 1.147 |
| Communicate research findings to the general public | | | | | | | | | |
| IGERT Graduate Students | 1 | 2 | 3 | 4 | 3 | 3 | 13 | 3.46 | 1.266 |
| Non-IGERT Graduate Students | 3 | 4 | 4 | 4 | 1 | 0 | 16 | 2.75 | 1.238 |

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.

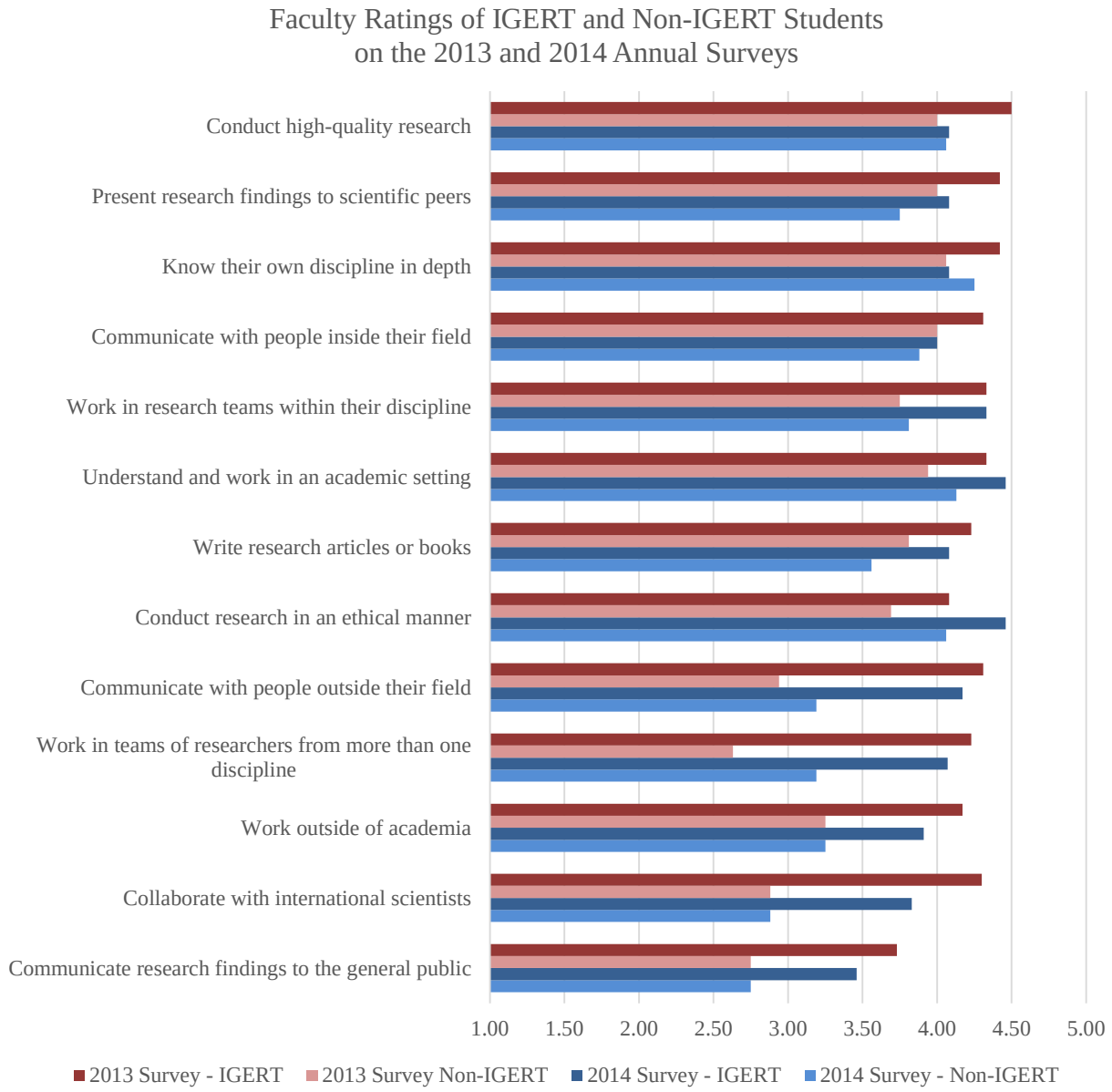


Figure 12. Faculty ratings of IGERT and Non-IGERT students on the 2013 and 2014 annual surveys (2013 IGERT n = 12, 2013 Non-IGERT n = 16, 2014 IGERT n = 13, 2014 Non-IGERT n = 16). Scale: 1 = Not Prepared, 2 = A Little Prepared, 3 = Somewhat Prepared, 4 = Mostly Prepared, 5 = Very Prepared.

### 2.2.6 Usefulness of WESEP 594: the Real Time Research Collaborative (RTRC) from the Faculty Perspective

Faculty members were asked a series of questions about WESEP 594: the RTRC. Their responses are given in Table 16. All responding faculty agreed that the RTRC was somewhat to very useful in each of the areas listed. They indicated that the RTRC was most useful for making industry connections, with all faculty agreeing that the RTRC was very useful in this area. The lowest rated item was related to teaching students how to do research, although all responding faculty still indicated that the RTRC was somewhat or

very useful in this area. Interestingly, faculty rated the RTRC much more highly than the students did in their responses (student responses are shown in Table 8).

As shown in Figure 13, faculty rated WESEP 594: the Real Time Research Collaborative slightly higher in most areas on the 2014 survey than they did on the 2013 survey. However, faculty reported that the RTRC was slightly less useful at teaching students how to do research and stimulating and enhancing students' research productivity on the 2014 survey than they did on the 2013 survey. Faculty rated the RTRC more than half a point higher on its usefulness for making industry connections on the 2014 survey than they did on the 2013 survey.

**Table 16: 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 | 4 | 3 | 8 | 7 | 3.43 | 0.535 |
| Stimulating and enhancing students' research productivity | 0 | 0 | 3 | 4 | 9 | 7 | 3.57 | 0.535 |
| Facilitating students' interdisciplinary work | 0 | 0 | 3 | 4 | 10 | 7 | 3.57 | 0.535 |
| Enhancing students' communication skills | 0 | 0 | 2 | 4 | 11 | 6 | 3.67 | 0.516 |
| Enhancing students' awareness of and ability to respond to ethical issues | 0 | 0 | 3 | 3 | 12 | 6 | 3.50 | 0.548 |
| Learning about environmental and policy issues | 0 | 0 | 3 | 4 | 13 | 7 | 3.57 | 0.535 |
| Making industry connections | 0 | 0 | 0 | 7 | 14 | 7 | 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 mean and standard deviation.

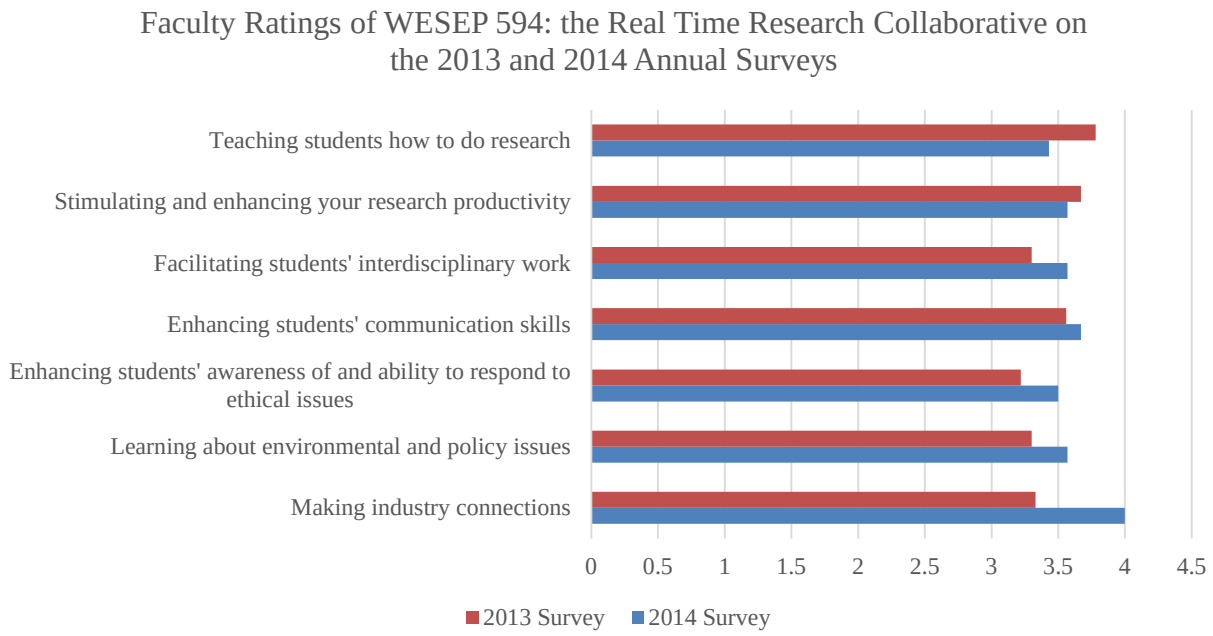


Figure 13. Faculty ratings of WESEP 594: the Real Time Research Collaborative on the 2013 and 2014 annual surveys (2013 n = 9, 2014 n = 7). Scale: 1 = Not at all Useful, 2 = A Little Useful, 3 = Somewhat Useful, 4 = Very Useful.

### 2.2.7 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 17. Sixteen faculty said they spent equal time teaching department courses, while two spent less time. Sixteen spent equal time advising departmental students, while two faculty spent more time doing this. Seventeen spent equal time conducting research with other departmental faculty, while one faculty membered indicated spending more time on this. All 18 faculty indicated that they spent the same amount of time engaging in department leadership activities.

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

**Table 17: Time Spent in Home Department**

| | Less time | | Equal time | | More time | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Teaching department courses | 2 | 11.1 | 16 | 88.9 | 0 | 0.0 |
| Advising department students | 0 | 0.0 | 16 | 88.9 | 2 | 11.1 |
| Engaging in department leadership activities | 0 | 0.0 | 18 | 100.0 | 0 | 0.0 |
| Conducting research with other departmental faculty | 0 | 0.0 | 17 | 94.4 | 1 | 5.6 |

### 2.2.8 How has IGERT influenced your professional life

Faculty were asked to indicate how IGERT influenced their professional lives (Table 18). On average, faculty agreed most strongly that they had been exposed to new ideas outside of their area of knowledge and that they had met faculty in other departments whom they would not otherwise have met. Twelve faculty agreed that they had been exposed to new ideas outside their area of knowledge while 10 agreed that they met faculty in other departments whom they would not have otherwise met. Ten faculty also agreed that they were more likely to conduct research with colleagues in disciplines outside their own, and 10 agreed that they were in a better position to obtain new research grants. Faculty were least likely to agree that they were able to work with students who were better qualified than non-IGERT students in their departments and that they had less time to conduct their own research, with only two faculty agreeing to each of these items.

Figure 14 displays the comparison of faculty members' responses regarding the impact of IGERT on their professional lives on the 2013 and 2014 annual surveys. Faculty tended to agree less overall on the 2014 annual survey, and differences between 2013 and 2014 responses were half a point apart on several items. The only item which faculty agreed more strongly to on the 2014 survey was *I have less time to conduct my own research.*

**Table 18: 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. | 1 | 2 | 1 | 10 | 2 | 16 | 3.63 | 1.088 |
| I have met faculty in other departments whom I would not otherwise have met. | 1 | 1 | 4 | 7 | 3 | 16 | 3.63 | 1.088 |
| I am able to work with a greater variety of students. | 1 | 1 | 4 | 8 | 2 | 16 | 3.56 | 1.031 |
| I am more likely to conduct research with colleagues in disciplines outside my own. | 1 | 1 | 5 | 9 | 0 | 16 | 3.38 | 0.885 |
| My teaching has become more interdisciplinary. | 1 | 3 | 6 | 4 | 2 | 16 | 3.19 | 1.109 |
| I am more likely to consider team-teaching with a faculty member outside my department. | 2 | 2 | 4 | 7 | 1 | 16 | 3.19 | 1.167 |
| I am in a better position to obtain new research grants. | 0 | 3 | 3 | 9 | 1 | 16 | 3.50 | 0.894 |
| I have learned new research techniques. | 0 | 4 | 5 | 6 | 0 | 15 | 3.13 | 0.834 |
| I can explore research topics that would not otherwise be funded. | 0 | 4 | 4 | 8 | 0 | 16 | 3.25 | 0.856 |
| I am able to work with students who are better qualified than non-IGERT students in my department. | 2 | 4 | 7 | 2 | 0 | 15 | 2.60 | 0.910 |
| I have less time to conduct my own research. | 2 | 2 | 9 | 2 | 0 | 15 | 2.73 | 0.884 |

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

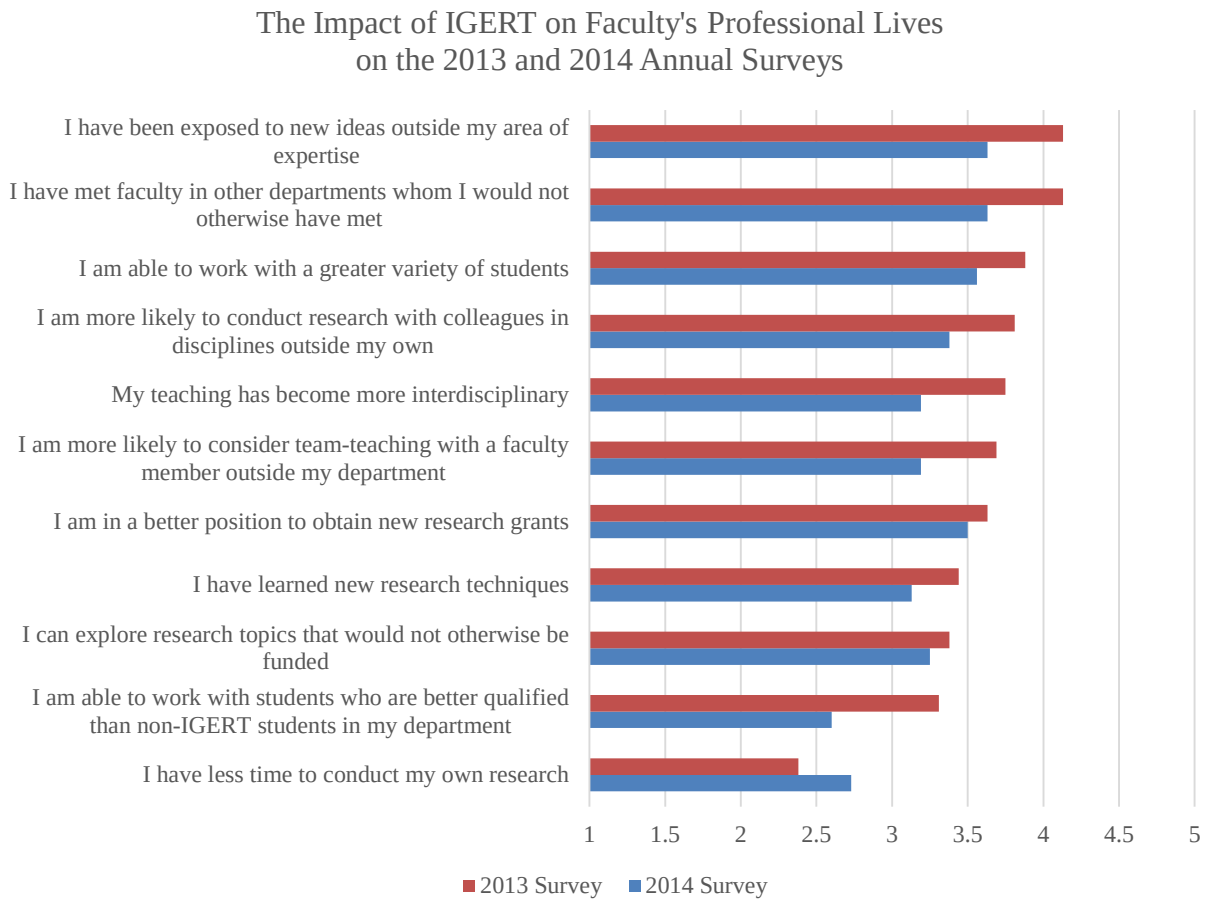


Figure 14. The impact of IGERT on faculty's professional lives on the 2013 and 2014 annual surveys (2013 n = 16, 2014 n = 16). Scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Neither Agree nor Disagree, 4 = Agree, 5 = Strongly Agree.

### 2.2.9 Impacts of IGERT on Faculty Home Departments

The impacts of the IGERT program on faculty members' home departments are summarized in Table 19. Fourteen of the responding faculty believed that the program altered the research scope of faculty involved in the program, while two reported it did not. Thirteen faculty said that the IGERT program did improve the quality of faculty research in their home department, while three faculty indicated that IGERT did not improve the quality of faculty research in their home department. Twelve of the responding faculty reported that the program improved faculty mentoring of students in their home departments, while four indicated that it had not.

Survey responses from the 2013 and 2014 annual surveys regarding the impact of IGERT on faculty members' home departments are displayed in Figure 15. Faculty members' responses were consistent in indicating a moderate impact in each area, and responses were the same on both surveys regarding the impact of IGERT on improving the quality of faculty research. Faculty reported less impact on altering the research scope of involved faculty and improving the faculty mentoring of students on the 2014 survey than they did on the 2013 survey.

**Table 19: 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 | 3 | 2 | 8 | 3 | 0 | 16 | 2.69 | 1.014 |
| Altered the research scope of involved faculty | 2 | 2 | 8 | 4 | 0 | 16 | 2.88 | 0.957 |
| Improved faculty mentoring of students | 4 | 2 | 7 | 3 | 0 | 16 | 2.56 | 1.094 |

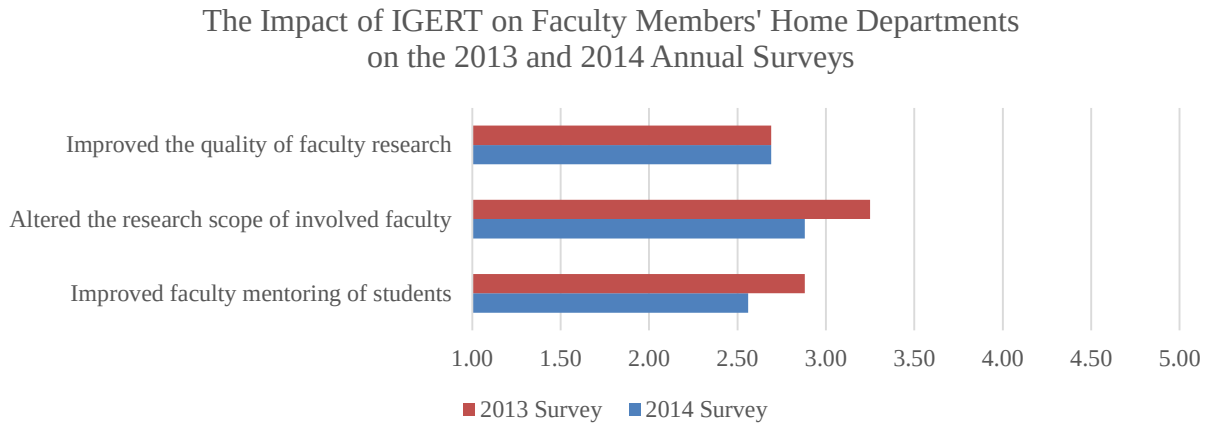


Figure 15. The impact of IGERT on faculty members' home departments on the 2013 and 2014 annual surveys (2013 n = 16, 2014 n = 16). Scale: 1 = Not at all, 5 = Extensively.

### 2.2.10 Suggestions of IGERT engaged faculty on ways to improve the WESEP IGERT program

**What suggestions do you have to improve the IGERT program?**

Faculty responses are listed below as they were provided.

- More openness - do not hear much. Ensure depth of materials in all related courses. Create opportunities for students to participate at the national conferences. Continue to improve student quality.
- It is difficult to want to take on a PhD student when only the first two years of support are promised. In my field, it seems to have become more difficult to get outside funding, and there is no guarantee of having support after two years of IGERT funding. I believe things would be much better if three or four years of support were provided, even if it meant a reduced stipend rate.
- Improve applicant pool.
- We need to find more ways to effectively recruit. We also need to better connect with industry and get industry involved in the students' research activities. We also need to get IGERT faculty better engaged with the overall concepts in the IGERT program,

e.g., I have been surprised to learn that some faculty are not aware there are funds to send students overseas.

- I had no information on the RTRC! Get better communication to those of us on the fringe of this activity.
- I think we can get the IGERT faculty more involved. Right now I am only advising my IGERT student, but I am very curious what other IGERT students are doing or what this program is doing in general.

### 2.2.11 Other Comments or Concerns of the WESEP IGERT engaged faculty

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

Only one faculty member listed any comments or concerns in this section of the survey. This response is provided below.

- My student needs to learn to work MUCH harder! I hope he is getting the message. He is very poor at keeping me informed on his IGERT activities, and I don't get direct communications that help me keep engaged with other activities than his project, on which he is making slow progress.

## 3. Student Focus Groups and Interviews

The evaluation team, led by Len Pietrafesa, with support from Brandi Geisinger and Mari Kemis, conducted WESEP IGERT student Fellow interviews in two formats. The first format was a focus group in which all current WESEP IGERT students were invited to participate. Ten students participated in the focus group, and all participating students consented to be audio-recorded. The second format consisted of individual interviews and was conducted with ten of the WESEP IGERT students, for which extensive notes were taken during and immediately after the interviews. The analysis of the student focus groups and individual interviews below was conducted on the full focus group transcript and the notes from individual student interviews. 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 are not distinguished from one another.

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, internships, graduate student climate, new student support, student recruitment, community outreach efforts, industry connections and opportunities, future employment, research, professional presentations and publications, international opportunities, double-degrees and the WESEP IGERT program sustainability. Overall, students seemed were very pleased with their experiences in the WESEP IGERT program. One student explained, "I'm very happy with the program. I personally would feel wrong if I complained about it, I've gotten so much out of it."

**Coursework**

***WESEP 594: The Real-Time Research Collaborative***

The WESEP IGERT students were asked to discuss their experiences in the WESEP course 594: The Real-Time Research Collaborative (RTRC). Overall, students found it to be a very useful experience and, in its restructured form, an integral part of the WESEP program. Students reported that the new format of 594 was more helpful than the original format, which they indicated felt overly taxing. Students also indicated that they found the progression of the course in the past two years helpful – they reported that as new doctoral students, it was helpful to hear more of the faculty research presentations and discussion on how to do research; while as more advanced doctoral students it was helpful to hear more of the presentations from industry representatives and outside speakers. They also agreed that it was beneficial to practice presenting their research in front of their peers, and they appreciated the interactions with their peers, and the feedback and constructive critiques that they received. Related, one student remarked it helped broaden communication skills, noting that, "It's very good experience to present your work to different people outside your home department." Students also reported that it was helpful to think about potential collaboration opportunities with the presenters. One student reported that 594 helped him to think about and how to better prepare for his prelims.

Students wondered how WESEP 594 should evolve to accommodate an expanding class size, given the matriculation of new students in future semesters. Students discussed the importance of balancing the needs of newer students (specifically related to hearing more information about how to do research) with the needs of the more advanced students, for whom it might not be beneficial to go back over introductory information or hear previous presentations. The majority of students seemed to feel, however, that it would be important to have newer students and more advanced students in the seminar together to provide community and opportunities to learn from one another. Students were also concerned that, with an influx of newer students, it might be difficult to make time for all of the student presentations, while still allowing time for guest speakers; especially ISU faculty, and scientists and engineers from the national lab and from industry.

Students expressed some concerns regarding the ways in which WESEP 594 is assigned credit and appears on their transcripts. Students indicated that they only receive one credit for WESEP 594 throughout their time in the program, despite the fact that they participate in the seminar each semester. They reported that the course appears on their transcripts as a repeated course; with the latest grade replacing the prior grade, in effect a 'do-over'. Students indicated that it was problematic to have it appear as a repeated course on their transcripts since they had been asked by prospective employers and internships why they needed to re-take the course. All agreed that the credits for 594 need to become cumulative. This latter adjustment would also increase the student credit portfolio and thus reduce the

need to scurry for extra courses to meet overall PhD credit requirements. This is highlighted as an issue that needs to be addressed by the WESEP leadership.

***WESEP 501 and WESEP 512***

Students also discussed WESEP 501, reporting that it was a good way for students coming into the program to learn more about other areas of wind energy and talk to people with different disciplinary backgrounds. Students felt that 501 was a good opportunity to connect with other new students and get a basic introduction to the program. Students who entered the program in the fall semester of 2014 reportedly felt more disconnected from their peers partially because WESEP 501 was not offered in the fall semester of 2014 due to a shortfall in course enrollment; as the incoming cohort of WESEP IGERT students did not meet the necessary quota. That said, the students wondered whether 501 could be exempted from the enrollment requirement, given the importance of the cornerstone importance of the course to incoming students. This is highlighted as an issue that needs to be addressed by the WESEP leadership.

Students expressed some concern that WESEP 512 would not be offered due to low student enrollment. Students felt it was an important and necessary part of the program and hoped that there would be a way to offer the course. Once again, the ISU enrollment criteria rule would have to be addressed by WESEP leadership.

***Qualifying Examinations***

Students did not seem to feel that it was overly onerous to have to take qualifying exams both in their home departments and in WESEP. In fact, students indicated that once they had finished one of the qualifying exams, the second qualifying exam seemed simpler. Students did have one area of concern related to qualifying exams - they felt it was important to have their major professors present at their WESEP qualifying exams to provide moral support, to advocate for the students, to serve as an expert who is intimately familiar with the student's area of expertise, and so that the major professors could see that their students were able to perform adequately. Students indicated that having their major professors present could become problematic if their major professors were not available at the same time as the WESEP committee was meeting. The opportunity of the WESEP IGERT students to 'double-major' was especially attractive to most of the students. They saw this as not only an opportunity to jointly acquire as much knowledge as possible in their cognate disciplinary field of study and also in the WESEP arena but also to build an academic record that would make them more competitive in their future professional pursuits.

**Internships**

Students appreciated having the opportunity to travel internationally and participate in internships through the WESEP IGERT program, and some students indicated that the international internship component was what attracted them to the program. They indicated that program leaders and advisors were helpful in guiding them to potential internship opportunities and assisting students with forming connections for potential internships. One student stated that his internship experience was very beneficial in helping him both learn to communicate and complete his dissertation.

Some students reported being confused about whether or not they were free to pursue internships anywhere, or whether they were restricted to participating in an internship at a partner institution. Students also mentioned that they hoped that the program could broaden the list of partner institutions and potential internship sites, specifically to include places outside of Europe.

A WESEP website that informed and connected students to professional society (such as the American Meteorological Society, the American Physical Society, the American Geophysical Union, the Institute for Electrical & Electronics Engineers, etc.) sponsored internship opportunities, some with federal agencies and with the U.S. Congress, could be highly beneficial. The creation of an all-purpose website providing 'HRL' linkages is an opportunity that WESEP leadership and the students could take on together.

**Graduate Student Climate**

Students all agreed that it was helpful to have desks in the shared WESEP graduate office. They reported that this space allowed for collegial, social and learning interactions with other WESEP graduate students was crucial in helping them to feel like part of a team, determine necessary coursework, and seek assistance or advice from other graduate students in the program; as the WESEP students have very varied backgrounds with diverse areas of expertise. Students felt that the graduate student climate was very positive and they reported that everyone got along. Newer students who reported not having a desk in the shared WESEP office space reported that they did not have a lot of interaction with other WESEP students and felt somewhat disconnected from the WESEP program. Some of the more advanced students worried that the newer students were missing out on the mentoring opportunities that exist in the shared office space, and one student commented, "Having a support network in graduate school is the best thing you can possibly have." Following the interviews and discussions, all of the new students who had not yet taken advantage of having a desk of their own in the shared space reported that they would be doing so post-haste.

Students discussed developing a mentoring program for incoming graduate students, wherein incoming students would be assigned a more advanced student who could serve

as their mentor. Students explained that it could be confusing to attempt to navigate co-majors and program requirements, especially when faculty advisors sometimes had not previously mentored a WESEP student and were not themselves familiar with the WESEP program requirements. Students felt like this would be especially important for new students who were unable to take WESEP 501 their first semester in the program.

**Student Recruitment and Community Outreach Efforts**

Students talked about traveling to other schools and conference in an effort to recruit new students to the WESEP IGERT program. Students seemed to enjoy doing this and felt that it was a valuable use of their time. Students were also hopeful that some of the students with whom they had spoken would apply to the program in the coming years. They also discussed the WESEP REU program as a potential avenue for recruiting students into the program.

A couple of students also talked about forming connections with the community through involvement at local events (e.g., a solar car stop, the Iowa State Fair) and with local high school teachers. Another student mentioned putting together a flier for the program. Other ways of engaging community members in discussions about wind energy, such as presentations to local rotary clubs, civic groups and the like, which are always looking for luncheon speakers, were also discussed.

**Industry Connections and Employment**

Some 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 and other research groups.

One student commented that she additionally felt that it was important for the WESEP program to begin preparing graduate students for employment. She felt that the program website could list current job openings or locations/industry connections that might be a good fit for WESEP students post-graduation. She also discussed that it would be helpful to have future program graduates invited back to talk to new generations of students about their careers and give them ideas of where to look for employment.

Here again, a WESEP website (discussed above) could be very helpful and useful to the IGERT students.

**Research and Publications**

Several students indicated that they were working on large research projects. Students' research topics were varied, with topics ranging from new tower structure designs to smart sensor fatigue detection materials, the Weather Research and Forecasting Model, wind

turbine blade inspection, turbine farm turbine-to-turbine interactions, turbine farmland interactions, and so on. Most students reported giving professional conference presentations, both oral and poster, and working on peer-reviewed publications on their research. Most had adopted the strategy of preparing chapters of their dissertations for separate, sequential publications. Several students noted that they were limited in being able to publish all of their research findings because of prior proprietary agreements with industry. This is an issue that will have to be addressed by WESEP leadership. ISU is a public university and IGERT is an NSF funded program and as such students must be allowed to publish their research findings, if the latter are part of their dissertations.

**WESEP IGERT Program Sustainability**

One student expressed concern about the sustainability of the WESEP IGERT program and whether the program would continue after the first five years, stating, "I just wish this program could last a long time….I wish [that] this program lasts forever." This student felt that the program was important and should continue, but also worried that the value of current students' WESEP IGERT degrees might be diminished if the program were to dissipate. WESEP leadership should discuss this concern with all of the IGERT Fellows.

## 4. Faculty Focus Groups and Interviews

Individual interviews were completed with ten ISU faculty members associated with the IGERT program. 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, nothing things that they particularly liked about the program and also suggestions for program improvement. Overall, faculty seemed to believe that the WESEP IGERT program was a valuable asset to the university and the field, that the IGERT student Fellows were of exceptional quality, and felt the program was well-managed. Faculty responses regarding things that they liked about the program and suggestions for program improvement are discussed in more detail below.

**Program Positives**

Faculty appreciated the high quality of students they were able to recruit to the program, and one faculty member commented that WESEP IGERT students are motivated in a way that other graduate students are not. Faculty found it useful to have two years of funding from the program to support graduate students, and they also commented that it was a benefit to be able to attract domestic students to ISU and to their respective home departments. Faculty also recognized the benefit for students to have double majors in that they are able to seek a wider variety of career opportunities. One faculty member remarked that it was very easy for students to find internships in Europe.

Faculty felt strongly that the program provided excellent collaboration opportunities for faculty and students, and stated that the program has brought in high-quality industry representatives as well. One faculty member indicated that he has been successful in getting funding in other places because of his involvement in the WESEP IGERT program and

new collaborations with other faculty members. Other faculty members also discussed putting in grant proposals with new IGERT collaborators.

**Suggestions for Program Improvement**

Faculty suggested that as the program grows, they hope that collaborations will continue to grow as well. One faculty member suggested that it would increase collaboration between WESEP IGERT faculty members if faculty had a centrally located set of offices that could be shared and a shared laboratory space. Faculty also suggested that an ISU campus center or institute would help the WESEP IGERT program expand and continue to grow, and discussed efforts to formalize this center. The faculty viewed the creation of such a center or institute as a vehicle to encourage and facilitate a strong wind power industry component, perhaps with co-locations on the ISU campus, and also engagement of the U.S. Department of Energy (DOE) AMES National Lab; which is co-located on the ISU campus. They further discussed the need to increase involvement and collaboration with industry and the DOE AMES Lab in research and through student internships. Here it should be noted that there is a COE's Dean's "Initiative" in Wind Energy that WESEP/IGERT students could/should be taking advantage of. WESEP leadership could pursue this opportunity.

One faculty member commented on the difficulty of recruiting high-quality domestic students. Faculty also mentioned that it can be frustrating those faculties are not necessarily compensated by federal agencies for the amount of effort that they actually contribute to a research project, unlike graduate students, so there is less flexibility in their funding. Several faculties also complained that their IGERT students are only guaranteed support for two years. Here ISU administration has created a "Gap" program to cover ½ year or 1 year shortfalls in student support after Year 1 of a WESEP IGERT student's residency. Also, here, ISU administration is willing to "back-fill" a WESEP/IGERT student for 1 year if the program falls short of support".

Faculty commented that teaching WESEP courses has been and remains problematic because WESEP courses did not necessarily count toward their teaching load when they were not cross-listed in the faculty members' home departments. Here the ISU administration should be engaged by WESEP leadership to allow all WESEP courses to be cross-listed and engaged faculty be given credit for the % of the course that they teach (eg., 1 credit for teaching ~ $1/3^{rd}$ of a 3-credit course, etc.)

Several of the Co-PIs for the program commented that there were few incentives and little support for Co-PIs on an IGERT grant.

# Appendix A. Annual Student Survey

**WESEP IGERT Student Survey 2014**

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.

When did you first start the wind energy graduate program?

- ○ Fall 2012
- ○ Spring 2013
- ○ Summer 2013
- ○ Fall 2013
- ○ Spring 2014
- ○ Summer 2014
- ○ Fall 2014

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 possbilities | ○ | ○ | ○ | ○ | ○ |
| 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 were 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 interndisciplinary 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 | ○ | ○ | ○ | ○ |

| 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

**2014 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 were the Real Time Research Collaboratives (RTRC)s 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.