

## ***Preliminary Observations on Faculty and Graduate Student Perceptions of Questionable Research Conduct***

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When thinking about how graduate students learn the values and standards of science, most universities and departments utilize an apprentice model. In this model, students learn values and ethics by observing their mentor and through working with the mentor—learning via a kind of “osmosis” process. However, the mentoring relationship between faculty advisor and graduate student is one of the most difficult and complex relationships in academia. This sometimes professional, sometimes personal relationship is generally beneficial to both individuals. Advisors usually help students develop their careers and develop professionally, as well as help students network and give them guidance with advice, support, and knowledge. Graduate students help their advisors by assisting with projects, increasing research productivity, increasing professional visibility through the student’s research, and can provide their mentors with personal satisfaction and a sense of competence (1, 2). Despite this mutually beneficial relationship, vital for a graduate student’s career in graduate school and beyond, faculty members receive very little, if any, training about mentoring. In fact, given this lack of formal preparation, some suggest the mentoring relationship can cause as much potential harm as it does benefits (1).

As a mechanism to transmit ethical codes and standards, the mentoring-apprentice model is, according to some investigators, not very effective (e.g., 3, 4). In order to provide faculty and graduate students with more effective methods of training and educating students about the responsible conduct of research, it would be useful to determine which aspects of the practice of research are most vulnerable to be misperceived, skewed, or violated. In this study, our definition of the responsible conduct of research includes (but is not limited to) honesty, reporting all collected data, using appropriate statistical analyses, and fairly recruiting research participants. Although there is some research describing the types and frequency of scientific misconduct by faculty members and by graduate students, there is little research examining both faculty and graduate student perceptions of violations of the responsible conduct of research. Nor do we know how concordant or discordant these “pairs” are. One purpose of this study was to assess these faculty and student perceptions. A second purpose of this study was to examine the training that students receive from their faculty advisors and departments. We hope to pinpoint how training can be improved and enhanced by examining faculty members’ and students’ perceptions of training and regulations (at both the department and university level).

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In order to investigate these issues, we sent a survey to faculty members and to graduate students in each of 30 Purdue University departments from the schools of Agriculture, Consumer and Family Sciences, Engineering, Liberal Arts, Science, and Veterinary Medicine. Faculty members were certified to chair students' doctoral committees and graduate students were certified by the graduate school as doctoral students. Seven hundred and thirty three faculty and 242 graduate students received copies of the survey, and we received a total of 241 surveys from faculty (of which 225 contained usable data) and 47 surveys from students (all of which were usable data).<sup>1</sup> Although the participation rate in this survey was comparable to previous research on similar issues with mail-in surveys (e.g., 5), we were disappointed that we did not receive more responses from students (which limited the analyses and results reported below). The distribution of returns by Gender and by Discipline are in Tables 1 and 2, respectively

	Female	Male
<b>Faculty</b>	47	162
<b>Grad. Student</b>	16	29

Table 1: Number of responses by gender

The percentage of responses from both male and female faculty members and graduate students matched the gender distribution for the entire faculty (faculty: 22 percent female and 78 percent male; graduate student: 35.5 percent female and 64.5 percent male). Equivalent comparisons of responses from the different disciplines were more difficult to make since different numbers of departments from each discipline were asked to participate. As Table 2 indicates, more responses were received from the Schools of Agriculture, Engineering, and Science. Only a few graduate students from Consumer and Family Sciences and from Liberal Arts participated. Most of the student responses were from Agriculture and from Engineering.

There were three parts of the survey. Part 1

Which of the following are ways that graduate students learn about professional values and ethical standards? (Circle all that apply).

1. Brown bag/colloquium
2. Special courses devoted to this topic
3. Interaction with faculty in research work
4. Codes of ethics and professional standards provided by professional organizations
5. Informal discussion of ethical problems when they occur
6. Department policies for teaching and research
7. Discussion of ethics and values in regular course work

Figure 1: Item 2 from Part 1 of the Survey

addressed how information about the responsible conduct of research is exchanged (Item 2 of Part 1 is shown in Figure 1). The questions in Part 1 focused on how and where students learned about the responsible conduct of research and if students and faculty knew of others who had been involved in ethical conflicts. The main section of the survey, Part 2, consisted of 38 hypothetical dilemmas (each included a proposed action to resolve the dilemma). The dilemmas were written to cover the following types of problems (which were supported the confirmatory factor analysis described below):

- 1) Information Sharing in the Lab;
- 2) Truth/ Completeness in Writing up Research Results;
- 3) Misleading the Audience (Plagiarism);
- 4) Seeking Credit for doing the Research; and
- 5) Consent Issues.

(Examples of the dilemmas for each factor are shown in Figure 2.) Participants responded by rating each dilemma on a five-point Likert scale (Strongly Disagree to Strongly Agree). The third and final section of the survey examined participant's perceptions of university and departmental policies on the responsible conduct of research and whether the faculty member or graduate students would feel comfortable reporting incidents of suspected misconduct.

	Agriculture	CFS	Engineering	Liberal Arts	Pharmacy & Medical Sci.	Science
<b>Faculty</b>	52	23	32	27	20	38
<b>Grad. Stud.</b>	13	4	10	2	7	7

Table 2: Number of Responses by School

- a. **Sharing Information:** Grant is in his office one day and sees his officemate's lab notebook open. While paging through the notebook, he discovers that Anli has found a way to metabolize ABC enzyme. Grant has been working for two months to discover a way to metabolize this enzyme for his dissertation. After thinking about it for a few days, Grant decides to use the same process to keep his dissertation on track. He does not bother to tell Anli because she is in his lab group and probably would not mind anyway. Do you agree with his decision?
- b. **Writing:** Mei has been collecting data for a long-term study for the past two years. Although she still is in the middle of the data collection phase, the trends she sees in her data are very exciting. She decides to write up her results and present them as a complete study and continue to collect data for the full term of the study. She plans to publish those data in at least two "follow-up" reports. Do you agree with her decision?
- c. **Misconduct:** Angelo has written an article in which he included a full paragraph from a paper written by a student for a class Angelo was teaching. Do you agree with Angelo's decision to include the paragraph?
- d. **Seeking Credit:** John has written an article in which he included a full paragraph from a pre-publication version of an article reviewing the research literature in his area of interest. The author of the article was planning to submit it to a prominent journal that publishes such reviews. Do you agree with John's decision to include the paragraph?
- e. **Consent Issues:** Professor Gleeson is conducting a research project concerned with social customs in a village in rural South Africa. The village consists of members of a single tribe, and is led by a tribal chief and council of elders who make all decisions for the village. The tribal chief insists that he will decide if his villagers can participate in Professor Gleeson's research project, and that he (the Chief) will distribute the payment to the villagers. Professor Gleeson may not ask the villagers whether they want to participate because that would be an insult and challenge to the Chief and Elders of the village. Do you agree that Professor Gleeson can go ahead with the research project if the Chief and Elders approve?

Figure 2: Sample Hypothetical Dilemmas from Part 2 of the Survey

(Two of these items are shown in Figure 3.) Items from both Part 1 and Part 3 were adapted from Judith Swayze and coworkers' survey of faculty and students (6). Items for Part 2 were written by the authors and were based on real events and scenarios gleaned from reading and teaching about the responsible conduct of research for the past five years.

Participants were given a response sheet to use as their answer sheet and were asked to return the response sheet in a self addressed envelope we provided them. Once we received the survey, a third party removed any identifying information. The responses on each survey form were entered into a computer file separately by the two authors. All coding errors then were reconciled by the authors.

## Results

*Part One.* The first questions focused on settings in which respondents learned some or all of their professional values. Seventy-two percent of faculty members and 60 percent of graduate students believed supportive faculty members

provided such information. Sixty-seven percent of faculty members believed professional organizations provided such information compared to only 15 percent of graduate students ( $t = 28.377$ ; Only values significant at .05 or less are reported). This difference probably reflected a lack of contact with such organizations by graduate students. Graduate students also relied more on other students as a source of information (51 percent), a source not considered by faculty members (15 percent,  $t = 16.97$ ).

Interactions with faculty in research work and informal discussions of ethical problems were considered effective settings to learn professional values by 90 percent or more of students and faculty. Brown bag discussions, colloquia, and courses, on the other hand, were not seen as effective settings by most respondents (percentages all less than 30 percent).

We also asked whether respondents ever discussed with peers value issues related to external sources of research funding or the application of research findings. Eighty percent

2. How active a role does your department <u>actually take</u> in preparing graduate students to recognize and deal with ethical issues in your field as part of their training?				
Very active	Active active	Somewhat active	Not very active	Not at all active
3. Could you report cases of suspected misconduct in your department without expecting retaliation?				
Misconduct by a faculty member: Yes definitely, Yes, Probably, Probably not, Definitely not				
Misconduct by a graduate student: Yes definitely, Yes, Probably, Probably not, Definitely not				

Figure 3: Items #2 and #3 from Part 3 of the Survey

of faculty members and 47 percent of the graduate students ( $t = 18.263$ ) did so. In addition 38 percent of faculty members and 11 percent of graduate students actually knew someone who had refused to participate in a research project because of personal reservations about funding sources. These faculty-student difference probably reflects differences in age and experience in the field.

What is clear from these analyses is that faculty members and students do have different views of the best place or way to learn about professional standards and to learn to recognize ethical research issues.

*Part 2: Hypothetical Dilemmas.* A confirmatory factor analysis of the hypothetical dilemmas produced five factors: 1) Information Sharing in the Lab; 2) Truth/ Completeness in Writing up Research Results; 3) Misleading the Audience (Plagiarism); 4) Seeking Credit for doing the Research; and 5) Consent Issues. The alphas for these variables were moderate, ranging from .47 - .61. We recognize that not all of the dilemmas applied equally to all of the disciplines sampled in this survey, but we were pleased that some general factors appeared. The nature of the five factors can be explained in several ways. First (and probably foremost) is the construction of the scenarios by the principle investigators. Construction of these scenarios was not a random process, and the factors extracted from the analysis may simply confirm biases and predispositions that entered into our construction of the items. On the other hand, the areas represented by the five factors have been identified by many investigators as areas of concern vis-a-vis research ethics. The fact that these items hang together at all may be a confirmation of the concerns many investigators and ethicists have about the process of research.

Although we could not adequately examine the faculty-student differences on the responses to the Hypothetical Dilemmas because of the disparity in the number of responses from each group, we were able to draw some tentative conclusions. Faculty members clearly took “more extreme” views than did students. That is, faculty members were more likely to indicate strong disagreement or agreement with the action taken in a dilemma than were graduate students. For example, on the 20 dilemmas that contributed to the five factors, more faculty members responded “strongly agree” (or “strongly disagree”) on every dilemma. Graduate students had more moderate responses. Actually, there were no faculty-student differences in the number of combined “strongly agree” and “agree” (or “strongly disagree” and “disagree”). Thus for the second item in Figure 2, of the 98 percent faculty members who disagreed with the action, 80 percent checked “strongly disagree.” All of the graduate students disagreed with the action, but only 43 percent expressed strong disagreement. Perhaps faculty members’ greater experience with ethical issues has led them to be more certain of their views (or the students’ lack of experience led them to be more tentative).

Finally, while the responses to the hypothetical dilemmas made intuitive sense, the construction of the dilemmas is more complex than we thought. Respondents often commented that they saw some items as dealing with multiple ethical issues or that there was not enough information presented to make a judgement. This may be one reason alpha levels were low for the five factors. More thought must go into the development of items that have a more specific focus (and are less complex) for a survey of this type.

Two sets of analyses were not computed. Analyses to compare factor scores for students with those of faculty were not conducted because the factor scores have not yet been corrected for directionality differences. That is, some factors include items with which most respondents agree and items with which most respondents disagree. The point values for these items needs to be on the same scale or have the same valence in order to examine factor scores. The other analyses not yet conducted would have compared student responses with those of their mentors. These analyses depended on both the student and his or her mentor actually submitting a survey, and having the student identify his or her mentor. Unfortunately, we were able to identify only five faculty-student pairs, precluding any analysis of whether the two are concordant or discordant.

### Questions about department and university policies

The questions in Part 3 focused on respondents perceptions of the role that departments should take and actually do take in preparing students to recognize and deal with ethical issues (see Tables 3 and 4). Significantly more students than faculty (70 percent vs. 45 percent) reported almost no effort by their departments to train them to recognize and deal with ethical issues in science (it also is interesting that 16 percent of faculty members thought their departments were active, but only 6 percent of the students shared that perspective). Thus both faculty and students believe academic departments should take a more significant role in training graduate students to recognize and deal with ethical issues (we only asked about academic departments, faculty members and students may actually ascribe greater responsibility to larger academic units—e.g., schools, graduate school, etc.). There is a mismatch here—faculty and students wanting departments to take a role and departments not doing that. And there is no formal structure at the university level for training in the responsible conduct of research. Thus, the student is left to his or her own devices. The most frequent choice made by students seems to be to ask another student or to ask the advisor.

The next two questions asked whether one could report misconduct by a faculty member or by a graduate student without expecting retaliation. The results in Table 6 show that 89 percent of faculty members believed they could report misconduct by a graduate student “safely.” They would expect no retaliation. The graduate students also seemed less concerned about retaliation if they reported misconduct by another student. Seventy-three percent thought it was safe to report misconduct by another graduate student. Reporting misconduct by faculty members was another matter. Fewer faculty members were comfortable about reporting misconduct by a colleague (73 percent). Only 55 percent of students thought they could report misconduct by a faculty member “safely.” In contrast, 28 percent of the faculty members who responded said they would not feel safe reporting misconduct by a faculty colleague. Almost half of the graduate students, 44 percent, were concerned about retaliation for reporting a faculty member’s misconduct. These results seem consistent with anecdotal data. A cursory review of comments from the electronic list-serve Sci-Fraud reveals a concern by many participants that to make a good faith allegation that a faculty member has engaged in misconduct is to place one’s career in jeopardy.

Finally, we asked about knowledge of university and departmental policies on misconduct. Half of graduate student respondents did not know that the University has a research misconduct policy and 72 percent do not know if their department has such a policy. The faculty were more knowledgeable—63 percent knew there was a university policy. However, only half of them were familiar with the policy’s contents.

	Very active	Active	Some-what active	Not very active	Not at all active
<b>Faculty</b>	37	45	14	03	01
<b>Grad. Stud.</b>	22	52	22	04	00

Table 3: Role a department should take (percent agreeing)

	Very active	Active	Some-what active	Not very active	Not at all active
<b>Faculty</b>	02	14	38	34	11
<b>Grad. Stud.</b>	02	04	26	51	17

Table 4: Role a department does take (percent agreeing)

<b>Respondents</b>	<b>Misconduct by</b>	<b>Definitely Yes</b>	<b>Probably Yes</b>	<b>Probably Not</b>	<b>Definitely Not</b>
<b>Faculty Members</b>	Faculty	32	41	23	05
	Students	48	41	09	01
<b>Graduate Students</b>	Faculty	04	51	40	04
	Students	11	62	23	04

Table 5: Reporting Misconduct Responses (percent agreeing)

**Conclusions:**

The hypothesis that graduate students learn to identify and deal with ethical situations in research from their mentors without specific instruction or discussion could not be tested using the data collected in the first “pass” of our study. We received too few mentor-student data pairs to make any analysis. Our failure to obtain data relating mentor’s values directly to that of their specific students was disappointing—only five student—mentor pairs were identified (we hope to rectify this situation by increasing the size of the student data pool). However, we believe the modeling or osmosis hypothesis probably will not be supported because of the different perceptions graduate students and faculty members have of how scientific values are transmitted. Faculty members and students do rely on other faculty members, but only the students rely on their student peers. At the same time, both faculty and students believed that interactions in the work or lab settings would be useful in learning to recognize and deal with ethical situations. Unfortunately, this expectation means that people seem to want to learn from “personal experience,” but no one wants to have that kind of personal experience.

One thing is certain, things will not continue in the same way. Actions by the National Institutes of Health to require specific education on the responsible conduct of research generally specifically will require universities to do a better job. That better job might be facilitated with a more complete understanding of how students are learning now and by determining not only what they are learning, but also by determining what they are NOT learning.

**Notes**

1. These numbers differ from the totals in Tables 1 and 2 as some participants did not answer the gender or discipline questions.

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