PROMOTING ACCESS TO SCIENCE CAREERS: TRAINING FACULTY TO TEACH PROFESSIONAL DEVELOPMENT AND RESEARCH ETHICS

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In the United States, graduate programs in the biomedical sciences are designed to provide individuals with the training necessary to pursue an independent career in research. The curriculum typically involves a combination of coursework, in which students obtain depth and breadth in the subject matter of their discipline, as well as extensive practical experience planning, conducting, and analyzing original research. However, in order for individuals to develop into successful professionals, there is an additional set of abilities they need to cultivate: they must develop a set of general professional skills, including the ability to publish their work, give research seminars and other types of oral presentations, obtain employment and secure funding, balance multiple responsibilities, and behave responsibly. Traditionally this information has been transmitted primarily through interactions between a student and their advisor or mentor. However, this seems inefficient, at best, and it places a disproportionate burden on women, minorities, and first-generation professionals, who often have less access to mentoring than their male counterparts. Since 1995, the Survival Skills and Ethics Program at the University of Pittsburgh has offered an annual conference designed to prepare faculty to implement courses on these essential skills. A follow-up survey of participants (1995-2003) was conducted in 2004; the aims were to determine what instruction had been implemented, ascertain the barriers to implementation, and examine how much participants felt the conference contributed to their abilities to provide the training. The instruction implemented varied widely in terms of the duration and the number of students taught; on average, participants provided 37 hr of instruction to 87 students annually. Finding time to devote to teaching was, by far, the greatest barrier to participants implementing courses in professional skills and ethics. Most participants felt that the conference significantly enhanced their ability to provide such instruction. In sum, these data indicate that this trainer-of-trainers program was an effective mechanism for disseminating a curriculum designed to promote the socialization of students to the practice of science. These results have implications for optimizing trainer-of-trainer programs and reducing barriers to the implementation of instruction in professional development and the responsible conduct of research.

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PREFACE

Dedicated to the finest mentors I could ever imagine:

Mom, who taught me the ultimate set of survival skills and always believed in me

Marsha, who helped me survive and re-create myself

and Michael, my friend and mentor for 20+ years,
without whom the Survival Skills and Ethics Program would not have existed.

* * *

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The research undertaken for this dissertation was approved by the University of Pittsburgh's Institutional Review Board (approval #0608147).

1.0 INTRODUCTION

In the United States, graduate programs in the biomedical sciences are designed to provide individuals with the training necessary to pursue an independent career in research (2000a). The curriculum typically involves a combination of coursework, in which students obtain depth and breadth in the subject matter of their discipline, as well as extensive practical experience planning, conducting, and analyzing original research. However, in order for individuals to develop into successful professionals, there is an additional set of abilities they need to cultivate: they must develop a set of general professional skills, including the ability to publish one's work, give research seminars and other types of oral presentations, obtain employment and secure funding, and balance multiple responsibilities (NAS 1995b; Fischer and Zigmond 1998; Anderson et al., 2001; COSEPUP 2000; Sincell 2000). Indeed, these skills are so important that they are sometimes referred to as "survival skills" (Fischer and Zigmond 1998).

Traditionally these professional skills have been transmitted primarily via informal mechanisms, namely through interactions between a student and their mentor. However, as science becomes more complex and competitive, the amount of time a mentor has to spend with their mentee has decreased (Garte 1995). Moreover, studies have shown that individuals from underserved populations (e.g., women, minorities, first generation professionals) have less access to mentors than their traditional counterparts, thus placing a disproportionate burden on the underserved (National Science and Technology Council 2000b; American Association of Medical Colleges 2002; National Research Council 2005).

The Survival Skills and Ethics Program at the University of Pittsburgh, which was initiated in 1985, was developed to address the need by providing a formal mechanism for learning professional skills. Over the years, instruction in survival skills has been provided in a variety of formats (e.g., brown-bag workshops, a formal course, occasional half-day workshops). Over that time, the program evolved into its current format: a series of 8 annual 1-day (6-hr) workshops on a topic related to professional development and the responsible conduct of research (Table 1). The workshops are offered one per month, in the fall and spring semesters, and each is self-contained so that participants need only attend the workshops relevant to their current needs and interests. The program serves individuals from any discipline who are obtaining advanced training in research.

In 1995, the Survival Skills and Ethics Program initiated an annual 1-week trainer-of-trainers conference designed to provide faculty and administrators with the instruction and curricular materials necessary to provide training in professional development and ethics. Through that venue, the curricular materials developed for the workshops at the University of Pittsburgh were disseminated nationally. Funding for the conference was provided in the first couple of years by the National Science Foundation and in subsequent years by the National Institutes of Health.

A maximum of 40 conference participants were selected each year by the Program Directors based on the information provided by individuals in their application form (Appendix A). In 2004, a follow-up survey was undertaken to assess the impact of the conference on past participants and their efforts to provide training in professional development and/or research ethics. The aims of the survey were to determine the characteristics of instruction that had been implemented, ascertain the barriers to implementation, and examine how much participants felt the conference contributed to their abilities to provide the training. The analysis and interpretation of those data is the focus of this dissertation.

Table 1. Survival Skills & Ethics Workshops offered annually at the University of Pittsburgh

Workshop	Topics Covered	Ethical Issues Discussed
1. Training for Success	How to be a successful graduate student or postdoctoral fellow: selecting an advisor and a research project, developing a training plan, and managing time and stress.	Record-keeping; fabrication, falsification, and plagiarism; whistle blowing.
2. Making Oral Presentations	How to develop and deliver research seminars and poster presentations, answer questions, minimize nervousness, and deal with emergencies during the presentation.	Accuracy in describing and depicting data; scholarship; use of information obtained in a presentation by someone else; modifying information to promote effective communication with the lay public.
3. Teaching	Developing and delivering a course for undergraduate or graduate students; steps involved in planning; lecturing and leading discussions; developing a grading plan and exams.	Promoting equity in the classroom; avoiding inappropriate relations; making special accommodations; fairness in grading.
4. Writing Research Articles	The anatomy of a research article; the steps involved in writing and publishing an article, dealing with reviewer's criticisms.	Determining authorship; plagiarism; proper citations; integrity in presenting data; mandates on sharing unique reagents; confidentiality in the review process.
5. Job Hunting	Finding a position that matches your skills and interests; preparing CVs and resumes, cover letters, and statements of research and teaching interests. How to be successful on an interview.	Accuracy in preparing CVs and resume and in answering questions during interviews; responding to illegal questions

6. Grant Writing	Types of funding agencies and mechanisms; the anatomy of a research grant application; characteristics of proposals for fellowship and career awards; habits of successful grant writers.	Accuracy of data, biosketches, descriptions of collaborations, and budgets; use of funding; confidentiality and fairness in review.
7. Creativity & Intellectual Property	Creativity: What is it and can it be developed? How to protect your intellectual property: copyrights and patents. (This workshop is offered in alternate years, and replaced in off-years by a second workshop on grant writing.)	Determining who “owns” the data and inventions; sharing of unique resources and reagents.
8. Advanced Professional Skills	How to establish your own research program and be successful; strategies for attracting, hiring, supervising, and evaluating students and staff; how to balance personal and professional obligations.	Fair hiring and supervising practices; not showing favoritism; handling suspicions of fraud by a subordinate; social responsibility.

1.1 PROBLEM STATEMENT

The Program Directors of the Survival Skills and Ethics Program believe that it is important for trainees to receive formal instruction in professional development and the responsible conduct of research. Traditionally, this type of instruction has not been part of graduate and postdoctoral training programs in the sciences. Seeking to address this need, the Program Directors developed a trainer-of-trainers conference to “seed” workshops and courses on these topics at institutions across the United States. The objective of the current research project was to examine the efficacy of that program with regard to the promote the implementation of courses in professional development and ethics at other institutions. This entailed examining (1) the impacts of the conference on the participants, (2) characteristics of training implemented by participants, and (3) barriers to implementation.

1.2 RESEARCH QUESTIONS

The specific research questions examined are as follows:

1. To what extent did the conference have an impact on the participants with regard to

a. Their ability to teach survival skills?
b. Their ability to teach ethics?
c. Their own professional growth?
d. Their awareness of issues related to professional development and ethics?

2. What were the characteristics of the training implemented by participants?

1. Hours of training provided
2. Number of individuals taught
3. Course sustainment

3. What barriers to implementation did the participants face?

a. Lack of time
b. Limited funding
c. Lack of curricular materials
d. Low level of participant interest
e. Other faculty discouraged efforts
f. Administration discouraged efforts
g. Lack of administrative assistance
h. Difficulty meeting the needs of a diverse audience
i. Difficulty recruiting additional faculty (if additional faculty were desired)

The questions listed above will be examined with regard different independent variables, including the following:

1. All participants
2. Participant's race
3. Participant's gender
4. Participant's rank
5. Participant's discipline
6. Participant's type of institution
7. Location (national or international)
8. Taught professional skills or ethics prior to attending conference
9. Attended conference with a teammate
10. Received a travel fellowship to attend the conference

A complete explanation of the comparisons to be made is provided in Table 2.

1.3 SIGNIFICANCE OF THE STUDY

This study contributes to the literature on how to construct trainer-of-trainers conferences to better promote the dissemination of educational programs in higher education. The results of this study also provides the Directors of the Survival Skills and Ethics Program and their funding agencies with feedback regarding the effectiveness of the trainer-of-trainers conference to date. The results can be used to inform the refinement of the conference program and curricular materials.

1.4 LIMITATIONS OF THE STUDY

1.4.1.1 Population surveyed

The population consisted of a highly diverse and carefully selected group of individuals, which is unlikely to be replicated elsewhere. The participants were self-selected and then screened by the Program Directors. All participants demonstrated a high commitment to implementing instruction. It seems unlikely that the results would be similar for a group of individuals who were directed to attend the trainer-of-trainers conference and/or required to subsequently provide instruction.

1.4.1.2 Survey response rate

Twenty-seven percent of the individuals surveyed did not respond, and the degree of similarity between respondents and non-respondents was not assessed. It is possible that compared to respondents, non-respondents were less likely to have implemented instruction. If so, the statistics on implementation would appear more positive than they would have if everyone had responded.

Participants' responses

The respondents may not have provided accurate information. That might have resulted from incorrect memories (many of the participants attended the conference more than 5 years ago), and/or because they were providing what they thought was a more "socially desirable" response.

1.4.1.3 Different types of courses implemented

The types of training in professional development and/or research ethics implemented by participants differed greatly, in terms of format, class size, hours of instruction, trainee rank, topics covered, and disciplines served. In addition, some individuals provided instruction in two or more venues (e.g., a course and some workshops). Participants were asked to submit a total for the number of hours of instruction provided and the number of participants served. Because of the survey construction, in the case of participants who taught in multiple venues, it is not possible to know how many trainees came to which of the events. Thus it is not possible to calculate "person-hours" of instruction provided.

1.4.1.4 Assessment of attitude

Using a Likert-type scale, participants were asked indicate the impact that the conference had on them. For example, one of the questions asked participants how much their attendance at the conference impacted on their ability to teach survival skills. Thus, the data collected represent participant attitudes rather than an empirical measure of their ability. It also is possible that participants mis-estimated or mis-remembered the extent of the impact of the conference on them, thus introducing a source of error.

1.4.1.5 Quality of instruction

The quality of the courses implemented by participants was not evaluated.

1.5 DEFINITION OF TERMS

Within this document, terms are used as follows:

Course: The survey did not distinguish among instructional venues. Thus, the word *course* is used generically in this document; it can refer to any instructional event. For example, it may refer to a college or university course, or a series of workshops or brown-bag luncheons.

Diversity: The inclusion of groups traditionally underrepresented in science. The use of the term in this document reflects the way in which the term *under-represented* was defined by the NIH in 2004, the year the survey was implemented. That is, it specifically refers to under-representation of racial and ethnic minorities, women, and persons with disabilities in the sciences (Department of Health and Human Services 2000). Since then, NIH has broadened their definition of underrepresented to also include individuals who come from families that are economically disadvantaged and individuals that are from "*a social, cultural, or educational environment…that [has] demonstrably and recently directly inhibited the individual from obtaining the knowledge, skills, and abilities necessary to develop and participate in a research career*" (Department of Health and Human Services 2006).

Implemented: This refers to instruction established subsequent to a participant's attendance at the trainer-of-trainers conference. It may consist of a newly implemented offering or what a participant deemed to be a "significant revision" of a course that they were teaching prior to the conference. With a few exceptions, the survey did not distinguish among the two conditions.

Minority, Minorities: Unless otherwise specified, these terms refer to individuals who are members of under-represented minority groups, as defined below.

Participant: An individual who attended a trainer-of-trainers conference. This term is used to refer to them before, during, and after the conference. After the conference, those individuals are to establish courses in professional development and/or research ethics for their students. Thus they hold a dual role.

Socialization: The process through which an individual becomes aware of, and adopts, the normative values and behaviors of a socially defined group.

Trainee (or student): The recipient of instruction provided by a conference participant. This term is independent of rank. For example, a trainee might be an undergraduate or graduate student, postdoctoral fellow, resident, faculty or staff member.

Travel fellowship: A scholarship that covered all but $325-350 (depending on year) of the costs of an individual's participation in the conference. It included travel, meals, and lodging (double occupancy). Fellowships were provided on the basis of the participants' financial need, which was self-reported.

Under-represented minority: Individuals of following races or ethnicities: Black or African American, Hispanic or Latino, Native American, Alaskan Native, Native Hawaiian or other Pacific Islander. (See *underrepresented,* above)

2.0 LITERATURE REVIEW

This chapter begins with a brief discussion of the growing need in the United States for scientifically trained personnel. The next two sections of the chapter focus on the socialization of individuals to the practice of science, and gender disparities in the careers of scientists in academia. The sections include a discussion of ways in which the process of socialization and the practice of science may contribute to disparities in career attainment. Finally, the chapter concludes with a discussion of the trainer-of-trainers model for use in disseminating curricular innovations.

2.1 THE SCIENTIFIC WORKFORCE

The U.S. scientific enterprise has expanded tremendously over the past 50 years. In large part, this has been a reflection of a great influx of government funding into academic organizations after WWII (National Science Board 1997), as well as increased exchange of research findings and products among nations after the end of the Cold War and with development of a global marketplace (National Science Board 1997; National Science Foundation 2006). Looking toward the future, the National Science Foundation (2006) has predicted that the need for scientifically trained personnel will continue to increase. Their conclusion was based on several factors: (1) continuing expansion in the science sectors of the economy, including growth in privately funded research as spurred by government policies that facilitate the commercialization of findings from academic labs, (2) increasing pressures for U.S. research to be competitive with other nations, particularly with regard to those in Asia, (3) a decrease in the number of internationally trained scientists working in the United States post 9/11, and (4) an increase in the rate of retirements among scientists.

In addition increasing needs for scientifically trained personnel, the National Science Board (2006) also has indicated that it would be prudent to increase the percentage of women and under-represented minorities within the scientific workforce. Traditionally, employment in the sciences in the U.S. has been the purview of Caucasians (Etzkowitz 2000; Rosser 2004). Based on current trends, Caucasians are expected to comprise decreasing fractions of the U.S. population (United States Census Bureau 2004). Without diversification, there will not be enough scientifically trained personnel to meet the nation's needs (National Science Foundation 2006).

2.2 TRAINING IN PROFESSIONAL DEVELOPMENT & RESEARCH ETHICS

In the United States, graduate programs in the biomedical sciences are designed to provide individuals with the training necessary to pursue an independent career in research (National Science and Technology Council 2000a). The formal curriculum typically involves a combination of coursework, in which students obtain depth and breadth in the subject matter of their discipline, as well as extensive practical experience planning, conducting, and analyzing original research. Students also undertake a series of exams in which they are asked to demonstrate their mastery of the material. Over the course of their program, graduate students thus are socialized to their discipline, i.e., they learn the language of their field, common methods of inquiry, and the ways that valid arguments are formed and presented (Braxton and Baird 2001). The length of such training programs varies by field; as of 2001, the average time to degree in full-time PhD programs in the biological sciences was 7 years (National Science Board 2004).

2.2.1 Skills needed for success in research and research-related careers

Certainly, mastery of one's discipline and relevant research methodology is essential for graduate student success in their training programs, as well as in their future careers as professionals in research and research-related fields (e.g., science policy, science law, research administration). Yet, those are not all the skills that are needed. The ability to successfully obtain employment and promotions will require developing a set of general professional skills, including being able to publish one's work, give research seminars and other types of oral presentations, obtain employment and secure funding, and balance multiple responsibilities (NAS 1995b; Fischer and Zigmond 1998; Anderson et al., 2001; COSEPUP 2000; Sincell 2000). Indeed, these skills are so essential that they are sometimes referred to as "survival skills" (Fischer and Zigmond 1998).

Despite the importance these survival skills to an individual's career, graduate students may not yet be aware of the need to acquire such abilities. However, it is not uncommon for individuals to comment later in their careers that their training did not prepare them to deal with many of the practicalities of their jobs (Anderson 2001; AAMC 2002; Wong 2004; (Gaff and Pruitt-Logan 1998). Unlike professional fields that address this concern by requiring residencies, internships, or other practica in which students function as professionals in their field, graduate programs in science typically do not provide such experiences.

Acculturation to graduate school itself can be quite difficult (Sullivan 1991; Golde 1998; Davis et al. 2001). As Golde has reported, *"new doctoral students often find the first year of graduate school stressful. Sometimes they feel stupid and incompetent, believe their admission was a horrible error...cannot imagine how they will get the reading done, and wonder whether they have not made a terrible mistake"* (Golde 1998, p.55). Indeed, she found that many of the students that drop out of graduate school do so in their first year. Thus, one of the initial survival skills that students will need to learn is how to survive their graduate training programs.

Part of the problem in some students adapting to graduate training is that they enter their graduate school with the misperception that graduate training consists of just several more years of college interspersed with lab work. However, not only is the amount of work significantly greater, the training program itself is qualitatively different (Sullivan 1991; Davis et al. 2001; Delamont and Atkinson 2001; Golde and Dore 2001). Over the course of their study, graduate students must transition from their current position as a *consumer* of knowledge, to a new position as a *creator* of knowledge (Nair; Sullivan 1991). Moreover, it is not just the formal curriculum that they will need to master. Weidman et al. (2001) sum it up well: "*If entering graduate students are to succeed in their new environments, they must learn not only to cope with the academic demands but also to recognize values, attitudes, and subtle nuances reflected by faculty and peers in their academic programs*." Indeed, socialization to the cultural norms is also an essential part of obtaining advanced training. It is through all of these experiences that students will begin to develop a professional identity (Braxton and Baird 2001).

Traditionally much information about the these professional skills and associated norms has been transmitted primarily via informal mechanisms, namely through interactions between a student and their advisor. However, as the scientific endeavor has become larger and more complex (see below), questions regarding the effectiveness of that model have arisen. These issues have come to the fore particularly as government and public attention have focused on concerns related to the responsible conduct of research (Alberts and Shine 1994; Institute of Medicine 2002).

Given the importance of survival skills to a student's career success, as well as the relevance of such information maintaining the integrity of scientific practice, the question thus arises: how do individuals in the sciences learn this essential information? Socializing influences differ greatly among individuals based on a number of factors, both individual and external, the most prominent of which are discussed below. It most cases, the students are impacted by a number of these forces; these are not exclusive of each other.

2.2.2 Agents of socialization

***Advisors**:* Advisors have traditionally been seen as the primary agent through which graduate students are socialized to their future profession. That is, students learned from their advisors the accepted behaviors and norms of their discipline (Alberts and Shine 1994; Garte 1995; Sprague et al. 2001). Graduate training in the sciences has typically been considered as apprentice type model, in which students work closely with the faculty member designated as their research advisor (Alberts and Shine 1994; Sprague et al. 2001). During that process, students receive extensive training in research, as well as routine exposure to, and discussions of, the norms of science and the survival skills needed by professionals (Anderson and Louis 1994; Garte 1995). This mode of training has a number of advantages, including the fact that it is highly adaptable to the individual needs of each student, and faculty members serve as role models for the students.

Recent changes in the practice of science have led to questions regarding the viability of the apprentice model. In the last half-century, funding for research has increased rapidly and the scientific endeavor has expanded exponentially (National Research Council 1998). Not only have the disciplines grown, but the size of individual laboratories has grown as well. For example, the National Research Council found that in the 1960s, a faculty member in the life sciences might have had 2 individuals working or training in their laboratory. In contrast, as of 1998 many labs included 20 or more persons, many of whom may be in training positions (National Research Council 1998).

With the expansion of the research endeavor, the research environment has become is extremely competitive (Alberts and Shine 1994). In academia, tenure-stream faculty positions are at a premium. There are significantly fewer positions available than there are PhD recipients in a given year (National Research Council 1998). Indeed, although the majority of graduate students indicate that a tenure-stream faculty position is their desired goal, fewer than 20% of PhD recipients in the sciences will be successful in obtaining that type of employment (Golde and Dore 2001; National Science Board 2004).

Competition for research grants is also fierce. Recent studies indicate that the average amount of time that elapses between a new scientists very first submission of an application for an R01 research grant (the standard NIH investigator-initiated award) and their success in obtaining an R01, is 4 years (Independence 2005). The median age at which PhD scientists when they receive that first research grant is 42 (Independence 2005).

A faculty member must balance a number of additional demands on their time, as well. These include teaching responsibilities, service obligations, as well as administrative issues such as managing budgets (Alberts and Shine 1994). In sum, these factors combine to severely limit the amount of time that an advisor has available to spend advising their students. Garte comments on the advisor's plight: *"The successful modern scientist tends to be an extremely busy individual. Without the time even to visit their own laboratories most such investigators rely on their senior professional staff (research associates, postdoctoral fellows, etc.) to keep them informed of progress and problems. Beginning graduate students in such environments might find themselves isolated from faculty advisors..."* (Garte 1995, p. 65).

Given the short supply of most advisor's time, trainees frequently must compete to obtain the attention of their advisor and other senior faculty members. In Anderson and Swazey's report on the results of the Acadia Institute's Project on Professional Values and Ethical Issues of Scientists and Engineers, approximately half of the 1440 graduate students that responded to their survey indicated that they needed to compete with each other for time with their advisor, and that only a few students got most of the advisor's time and access to resources (Anderson and Swazey 1998). And, as mentioned above, numerous studies have shown that women and minorities do not fare well in that regard: they routinely have less access to mentoring and advising than their white male counterparts (National Science and Technology Council 2000b; American Association of Medical Colleges 2002; National Research Council 2005).

Yet, even if time were available for advisors to mentor their trainees one-on-one, it is not clear that they (the faculty) would be effective. This is suggested by several factors: (1) Few faculty have had formal instruction in how to mentor their trainees (Independence 2005), and (2) it is not clear that all advisors have themselves achieved competency with regard to each of the professional skills (National Research Council 2005). (3) Even if an advisor is competent in performing the skill, they may not have give much attention to how to teach it (Skeff et al. 1997). (4) Faculty often overestimate students' knowledge of what professional practice entails (Anderson 2000b; Golde and Dore 2001; Austin 2002). And finally, (5) in the case of students whose backgrounds differ from that of their advisor in terms of gender, race, or culture, their advisor may not be able to anticipate the additional challenges that those students may encounter (Etzkowitz et al. 2000; Rosser 2004). Under such circumstances even the most competent advisor could find it difficult to systematically implement effective, individualized training in professional skills for each of their students.

There is yet one other variable that will affect the quality and quantify of mentoring received by trainees: the personalities and attitudes of both individuals involved (Austin 2002). Some advisors feel obliged to provided their students with quality mentoring, while other faculty see graduate students as little more than technicians, and use them merely as a means to an end, i.e., publications and grants (Sprague et al. 2001). Indeed, often expressed among faculty in the sciences is sink or swim attitude of the sort that *"either you have it or you don't, and if you don't, it is better for us to find out about it now…"* (Sullivan 1991).

Given the above factors, it is not surprising that there is a minimal level of direct interaction between a faculty member and their students. This is unfortunate, as that can greatly hamper their socialization. As Braxton indicates: *"the graduate faculty is a critical agent conducting this socialization because its members define knowledge and disciplinary values,* *model the roles of academics in the discipline, and provides practical help and advice"* (Braxton and Baird 2001).

Peers: Peers have been found to play an important role in the socialization of their fellow graduate students (Braxton and Baird 2001). After one's advisor, peers are the most important socializing influences and sources of knowledge about the discipline (Braxton and Baird 2001; Golde and Dore 2001). For example, in the Acadia Institutes' study referred to earlier, roughly half of the graduate students who responded said that they learned more from peers than from faculty (Anderson and Swazey 1998). More advanced students can provide information on what to expect from professors and what the professors will expect from you, how to negotiate obstacles in the system, what job interviews are like, and so forth (Davis et al. 2001). Moreover, influence of peers goes beyond mere relaying of information to other trainees. Studies indicate that that amicable relations within peer cohorts are an important way that professional values are conveyed, group norms are reinforced, and a professional identity is developed (Anderson and Louis 1994; Braxton and Baird 2001; Austin 2002). Again, however, minorities are at a disadvantage, as they may experience more social isolation than majority students. Likewise, women in departments that are overwhelmingly male have reported feeling isolated from peers (Sonnert and Holton 1995; Rosser 2004).

As noted above, advisors and peers are by far the most prominent mechanisms of socialization to graduate school and the profession. In addition to these mechanisms, there are a number of other vehicles that also provide students with information, albeit to a lesser extent. These include undergraduate research experiences, group functions, families of origin, coursework, and departmental climate. Each of these are discussed below.

Undergraduate research experiences: Undergraduate research experiences provide students with some anticipatory socialization to "real" research and the lives of academic professionals. Such exposure can help students who aim to attend graduate school with some knowledge about what they are getting into (see (Fischer and Zigmond 2004). This is quite valuable as the professional practice of sciences is vastly different than what most undergraduates are exposed to in their laboratory classes (Delamont and Atkinson 2001). Indeed, the latter is often antithetical to the practice of science, as experiments done as part of lab classes are designed to "work" whereas in real science, most of the experiments that are attempted don't work (Delamont and Atkinson 2001). Moreover, in some undergraduate labs students' grades are lowered if their experimental results do not conform to the “correct” answer, in essence a practice that socializes students to norms that run counter to accepted scientific practice (personal observation).

Group functions for graduate students: Many graduate programs offer orientation programs that are designed to provide new students with an introduction to graduate study and what it entails (Golde and Dore 2001). During this time, students usually meet some of the faculty and receive an overview of the program of study they have entered. However, it is not clear that these events are adequate to meet students’ needs for information about graduate work. This may be because some new student orientations tend to focus more on administrative procedures than on programmatic and developmental issues (Davis et al. 2001), and/or the orientations also occur while the new graduate students are distracted by moving to a new area and settling in (Golde and Dore 2001).

In addition some graduate programs, and/or the student’s department, may offer informal opportunities for students to network with peers, faculty, and visitors. Such events include receptions for speakers, brown bag luncheons, holiday parties, and events organized by an association of graduate students. Attendance at these functions is usually optional. However, some students do not understand the professional value of participating in community events and networking (Sullivan 1991; Pescosolido and Hess 1996). In addition, shyness or cultural differences may inhibit some students from attending in these events. Indeed, research indicates that international students do not to participate in graduate student functions (formal or informal) as much as their US counterparts (Anderson 2000a).

Family of origin: While the scientific endeavor has grown larger over the past 50 years, it has also become much more diverse (National Science Board 2004). Although traditionally the purview of white middle-class men (Etzkowitz et al. 2000; Rosser 2004), the influence of the civil and women’s rights movements have led to subsequent diversification of the scientific workforce. The number of women and underrepresented minorities in science training programs has increased, and international students now also make up a substantial portion of the community (National Science Board 2004).

As the academic environment becomes increasingly diversified, the needs of the students become more diverse (Austin 2002; National Research Council 2005). More and more first generation professionals are entering training programs (National Research Council 2005).

Unlike the children or siblings of academics, who have had the opportunity to assimilate a great deal of knowledge about academia and how it works, first generation professionals often enter training programs with little understanding of how the system works (Etzkowitz et al. 1992; National Research Council 2005). They often must spend much of their time struggling to learn how their program operates (Etzkowitz et al. 2000). For example, they may not know how to choose an advisor or understand what is reasonable to expect from their advisor, know what steps are involved in obtaining a degree, and so forth.

Courses/workshops: Separate courses in specific areas such as writing, public speaking, or pedagogy are another way students can learn some of the survival skills that are required for success in their careers. Courses and workshops provide extensive instruction in a specific skill and allows students to benefit from the experiences of faculty who are experts in these disciplines. However, in the sciences the time required to obtain a PhD has been increasing steadily over the past three decades, and it has been criticized as being too long by a number of organizations including the National Academy of Sciences (1995). Thus, it usually is not practical to insert several new courses into this already-full curriculum. Moreover, despite the fact that the instructors of the courses are well trained in their respective disciplines, they may not understand how to translate their knowledge into a form that is applicable to the needs and experiences of scientists.

In 1989, the United States federal government required that all individuals supported on federal training grants receive some training in the responsible conduct of research (US Department of Health and Human Services 1989). Some institutions have expanded their efforts and require this training for all of their graduate students. The types of instructional programs implemented varies widely across institutions, but the major methods that have been implemented by institutions to train such fellow are courses, workshops, and on-line instruction (Responsible Conduct of Research Educational Consortium). Whether such endeavors are generally effective in promoting the responsible conduct of research and discouraging unethical practices has not been adequately determined; it is an area of inquiry for which the federal Office of Research Integrity routinely solicits proposals (Office of Research Integrity 2005).

Departmental climate: Departmental climate influences what the student learns about the practice and norms of science (Institute of Medicine 2002). Indeed, some scholars have proposed that observation and osmosis is *the* major way in which students learn that information (Bird 2003). Studies by Anderson and others have examined the importance of departmental climate on the practice of research; she and her colleagues found that what students see around them often has a much greater influence on student behavior than what students are told about how to be responsible scientists. Indeed, the role of climate in influencing behavior is so great that the Institute of Medicine recently issued a comprehensive report on that topic, entitled *Integrity in Scientific Research: Creating an Environment that Promotes Responsible Conduct* (Institute of Medicine 2002). Part of what the Institute of Medicine recommends for promoting responsible conduct in research is that students receive formal instruction in many of the survival skills needed by professionals, including, of course, the ethical dimensions of those skills (Institute of Medicine 2002).

2.2.3 Programs developed to address unmet needs

In the sections above, common agents of graduate student socialization to the professional skills and norms of science were outlined. Given the limitations of these methods, numerous individuals and organizations involved in the training of scientists have called for reforms (Sullivan 1991; Golde 1998; Fischer and Zigmond 2001; Institute of Medicine 2002; Bird 2003; Wulff and Austin 2004). Many of their recommendations center around developing a curriculum that explicitly provides students with training in the professional skills and norms traditionally thought to be provided to the students by their advisor and osmosis. Some examples of the different types of programs that have been developed to meet this need are as follows:

Survival Skills and Ethics Program: This program offers workshops that provide students with a formal instruction to many of the professional skills they will need over the course of a career in research and research-related fields (www.survival.pitt.edu). The skills addressed run the gamut from strategies for success in graduate school to suggestions for developing an independent research program, hiring and supervising staff, and advising students. Discussions of the ethical dimensions of each skill are included throughout the instruction (Fischer and Zigmond 2001). The Survival Skills and Ethics Program also offers an NIH-funded, national trainer-of-trainers conference that provides faculty with the materials and instruction they need to start a professional development program at their home institution.

Preparing Future Faculty: This national program is designed to better prepare doctoral students for careers in the professorate (www.preparing-faculty.org). It is funded by Pew

Charitable Trusts, which has partnered with the Association of American Colleges and Universities, as well as the Council of Graduate Schools. Graduate students who participate in Preparing Future Faculty learn about the faculty responsibilities for teaching, research, and service, and they obtain some experience with those skills in a different types of academic environments. In particular, Preparing Future Faculty places a high emphasis on training students in pedagogy.

American Sociological Association: This professional society promotes the development of professional skills and ethics in a number of ways: In addition to having a written code of ethics (American Sociological Association 1999), they offer instruction in professional skills at their national conferences on topics such as how to complete a dissertation (see meeting schedule on www.asanet.org). They also encourage sociology departments and faculty to integrate professional skills training into their programs, and the Association publishes research and commentaries on teaching techniques that have been successfully used to accomplish that, in their journal *Teaching Sociology* (Keith and Moore 1995; Pescosolido and Hess 1996).

2.3 GENDER DISPARITIES IN CAREERS OF ACADEMIC SCIENTISTS

In the United States, science has traditionally been the domain of white males who are part of the middle to upper classes (Etzkowitz 2000; Rosser 2004). Relatively few women were admitted to higher training in those areas, and women who did pursue such training were at a severe disadvantage when it came to being hired (NRC 2001). Women were often hired into support positions (e.g., research assistants) and at a lower wage than what the males in their field. Moreover, for those women who did obtain faculty positions, their science was not viewed as rigorous, and they often had higher teaching requirements than their male counterparts (NRC 2001).

Since the 1970's, the number of women (the vast majority of them white) who pursue advanced training and employment in the life sciences has increased markedly. In 2001, women comprised 54% of all graduate students in biology, and in other areas within the life sciences, 30-40% of graduate students were women (NSB 2004). Nevertheless, despite the entrance of larger numbers of women into fields of science over the past 35 years, the pattern remains that few women make it to the top ranks in academia. A substantial number of women drop out of science at each rank in the academic career ladder, such that by the time one reaches the level of full professor, women comprise only 10-15% of the community (NSF 2004). This phenomenon of the attrition of women from academia as they progress through the ranks has come to be known as the “leaky pipeline” (Xie and Shauman 2003).

One might expect that with the increasing numbers of women pursuing higher education in the sciences that it is only a matter of time until the percentage of women in the top echelons of academic science increase. Unfortunately, this expectation has not borne out. The percentage of women in the higher academic ranks has only slowly risen. Given the relatively new entrée of larger numbers of women into graduate training, one might predict that disparities in their rank relative to men in the field might be due to their having worked fewer years in the field. However, it is clear that the disparities in the distribution of women in the upper ranks of academia persist even after the effects of years of employment is controlled for (Sonnert and Holton 1995, Rosser 2004)

2.3.1 Impacts of the under-representation of women in science

In addition to altruism, there are a number of other reasons why society as a whole should be concerned about the under-representation of women in academic science. The major reasons for this include the following:

National need for a trained scientific workforce: For the past several years, the US National Science Board has predicted an increasing national need for scientifically trained personnel in the 21st century (NSB 2004). In recent years, this need has been exacerbated by the decreasing numbers of international scientists who are trained and/or work in America following the terrorist attack of 9/11 and subsequent tightening of visa and immigration policies (Rosser 2004; NSB 2004).

Impact of multiple perspectives to scientific inquiry: Different groups of individuals (i.e., races, genders, economic classes) view and interpret the world through different lenses (Rosser, 2004). Given that the questions that researchers ask are shaped in part by the way they view and interpret the world, a more diverse scientific workforce may lead to new areas of inquiry, the application of different approaches for examining issues, and/or different interpretations of data sets. Thus, expanding the diversity of the scientific workforce could have a substantial impact on our ability to address previously intractable problems, including those related to how to treat or even prevent diseases.

The role of academia in educating scientists: Academia is the formal training ground for all scientists, regardless of whether or not they plan to pursue a employment at an academic institution. Research has shown that female role models and mentors of both genders are an important influence in women's pursuit of, and success in, science (Sonnert 1999). Women role models serve to reassure up-and-coming scientists that women can be successful in science, even as it is currently practiced (i.e., within a male dominated system). Mentors can provide women with encouragement and critical advice on how to "negotiate the academic system" (Sadker and Sadker 1994; Sonnert 1999, Golde and Dore 2001; NRC 2005).

2.3.2 Cause of the different experiences of men and women in science

A number of theories have been proposed to explain the differing experiences of men and of women in science. Two of the most common have been termed the "differences" and the "deficits" models (Sonnert and Holton 1995).

The ***differences theory*** posits that women are underrepresented in science because they are inherently less capable than men of doing science. This may be because of their different socialization experiences. It may also result from fundamental differences in the way women (vs men) think, and their type of cognitive approach is less suited to the pursuit of science as it currently is practiced (Sonnert and Holton 1995). This view has generally fallen out of favor. Indeed, that fact is evidenced in the uproar within the academic community following Harvard president Lawrence Somers' recent comments that women are underrepresented in math and science because of their poor aptitude in those areas, rather than due to systemic discrimination against women (Fogg 2005).

In great contrast to the differences theory, the ***deficits theory*** refutes the idea that women are inherently less capable than men of doing science. Rather, it proposes that the differences seen in the career outcomes of men and women, especially with regard to the attrition of women from academic sciences, is a result of structural inequities in how science is taught and practiced.

Given the implementation of title IX, which prohibits gender discrimination in schools, many blatant discriminatory practices have disappeared. Thus, in this model, most of the attrition of women is not perceived to result from blatant discrimination. Instead, it is often thought that most attrition is the result of the cumulative effect of small disadvantages within the system of science (Sonnert and Holton 1995). Much like the proverbial "straw that broke the camel's back," usually no one negative incident or disadvantage is enough to cause women to leave academia. However, the cumulative effects can build to a level that results in women dropping out. A large number of factors have been cited as contributing to the cumulative disadvantages that face women. Some of the most prominent of these are listed below.

2.3.2.1 Disadvantages in the work environment

Cultural discontinuities: In US society, men and women are socialized quite differently. In contrast to men, women are taught to help others, to participate in teams, and not to be overtly competitive (Sonnert & Holton 1995; Rossner 2004). Science, having traditionally been the purview of white middle to upper class men, privileges the male way of doing things. Thus, women find themselves at a disadvantage that has its roots in how they were socialized. Etzkowitz et al (2000) summed it up well: "Most faculty members in science and engineering departments treat young women the same as they treat young men. But this seeming equality actually differentiates against women in asking them to perform in ways that are contrary to their socialization."

Women scientists in academia are often expected to perform more non-research tasks then their male counterparts (Rosser 2004). The major areas in which this occurs is with regard to increased service, teaching, and student advising. As graduate students, females tend to be supported more frequently as teaching assistants, where as males tend to be supported as graduate research assistants (NSF 2004). This pattern continues when women look for jobs – more women than men scientists are hired into teaching positions (NSF 2003 and 2004). Indeed, even at predominantly research oriented institutions, women scientists tend to have larger teaching and advising loads than their male counterparts (Rosser 2004).

Women also are expected to do more service work than men, including working on committees. This is one of the ironic impacts of striving for diversity on committees. Because there is a relatively small number of women (and especially minority women) in academia, the women who are in academia tend to be asked frequently to be on committees, thereby reducing their ability to conduct research. This is not to say that service work, or the responsibilities of teaching and advising students is not worthwhile. Rather the problem arises because tenure and promotion decisions at research intensive and extensive universities (as defined by the Carnegie Foundation 2000; Appendix D) are based largely on a faculty member's *research* productivity. Faculty are given little, if any, credit for service work. Teaching abilities must be "passable" but otherwise it may not factor much into the tenure decision in the life sciences. Obviously it is critical that faculty know about these practices. However, this type of information on "how the system *really* works" (which sometimes contradicts what is written in formal policies) is often only communicated through informal networks (see below).

Lack of mentors: One of the biggest factors that women cite as an obstacle in their pursuit of a career in science is the lack of mentoring they receive (NTSC 2000; AAMC 2002; NRC 2005). Numerous studies have indicated the great importance of mentors to career success in science, particularly to women (Sonnert and Holton 1996; Weil 2001). Mentors can offer advice on science, career plans, and work-life balance. They can offer entrée into social networks (discussed below) through which much important professional information is informally communicated and opportunities arise. And not trivially, mentors can provide inspiration and encouragement to keep going when times get tough. Unfortunately, although academic advisors are plentiful, mentors are not (Swazey et al., 1994; Anderson et al., 2001; Golde 2001; NRC 2005). This seems to be a particular problem for women and members of other groups typically underrepresented in science.

Professional networks: One's network (i.e., all the individuals that one has personal contact with) can be a source of great social capital, one that is particularly important in the sciences. Not only does one's network provide information on the "unwritten rules" of how to survive and succeed in research, it also provides access to information on job openings, collaborators, students, funding opportunities, and even scientific information that is useful in one's research. Women often report a feeling of being left out of these professional networks, and of not having access to "mentoring provided in the men's room" or during activities (e.g., basketball games) in which few women typically participate (Sonnert and Holton 1995, MIT 1999; NSF 2003).

Space and other resources: Several recent studies (e.g., MIT 1999, NRC 2001) have shown that women have less access to resources necessary for science, including laboratory space, equipment, and start-up funding from their institution. This places women at a competitive disadvantage. Although a critic may argue that this is a result of women's failure to negotiate effectively for a new position, the widespread phenomenon suggests a more systemic problem. Some institutions have acknowledged this problem (MIT 1999) and are working to develop systems in which mechanisms are in place to ensure that research resources are allocated more equally.

Collaborations: Although it is in contrast to the way women have been socialized, female scientists tend to collaborate with fewer individuals than men do. Some women have indicated that this is because when they collaborate with men, they are often perceived as the weaker partner, and they sometimes have their ideas appropriated entirely (Sonnert and Holton 1995). Some have noted that at this time in history, collaborations are seen as essential to research success, as more projects are interdisciplinary, and/or projects tend to be larger than one researcher could effectively tackle (Etzkowitz 2000). Moreover, cross disciplinary collaborations are encouraged by the major funding agencies (i.e., NIH, NSF). Thus, the lack of collaborations can negatively impact women's careers.

2.3.2.2 Disadvantages related to family responsibilities

Dual career couples: The "two-body problem" refers to the situation in which both couples have professional careers and they want to find two jobs in the same geographic area. For women in academic science, this sometimes involves having to find two *academic* positions in the same academic field. This issue impacts on more women than on men as women are more likely than their male counterparts to have a partner who is an academic (Sonnert 1999, Rosser 2004). Moreover, in heterosexual relationships, women are more frequently geographically constrained with regard to their employment options (Rosser 2004).

Conflicting tenure and biological clocks: The scientific career path does not provide a easy or obvious time for one to have and care for children (Cole and Curtis 2004). Accommodation for individuals to give birth or take time off to care for a child or parent are not an integral part to the culture. Women who wish to finish their training before having children are often forced to deal with the conflicting needs of their tenure and biological clocks (Cole and Curtis 2004).

At most institutions, once appointed to the tenure stream, faculty have 7 years to achieve tenure. Theoretically at least, academia is a meritocracy and tenure is awarded based on how productive one had been during that time. Thus, individuals who take time off for childbearing or childrearing are in a weakened position, as their overall productivity would be judged against the productivity expected of someone who worked throughout those years. Yet, women who delay childbirth until after tenure may experience difficulties related to the effects of aging on fertility.

Some institutions have developed a system in which individuals can “stop the tenure clock” and take time off for family purposes (often 6 months to a year). Theoretically, this time is not counted as contributing to the pre-tenure years. However, in reality, taking such time off does affect women’s career outcomes (Cole and Curtis 2004). This may be through a direct effect of influencing the tenure decision, or it could result in women being viewed as less devoted to their work. Moreover, individuals who work in a field that is rapidly evolving (e.g., molecular genetics) may find the task of catching up almost overwhelming.

Available hours: Traditionally, science was done by men who usually had full time wives and thus these men could commit the vast majority of their waking hours to their science. This model, currently combined with the limited faculty positions and grant funding available, has resulted in having to spend large numbers of hours at work in order to be competitive. Indeed, in the life sciences, it would not be unusual for a successful researcher to be working 70 hour weeks (personal observation). Half-time employment is generally not an option at a research intensive/extensive initiations.

Women’s responsibilities for childcare and domestic life are typically greater than for those of men (Cole and Curtis 2004, NSF 2004) and limit the number of hours they can devote to their research. It may not be possible for them to participate in faculty meetings and receptions held late in the day, wining and dining of visiting colleagues, travel to professional meetings. Women are thus penalized professionally as it is difficult for them to participate in a number of activities seen as integral to academic science. Moreover, it is frequently assumed that their commitment to their families reduces their commitment to research (Etzkowitz 2000).

2.3.3 Potential ways to address inequities

The text above provides an overview to some of the major issues that negatively impact the careers of women in academic science. Because there are few women in some departments, women are often isolated from each other, and thus have little opportunity to compare experiences (MIT 1999). Consequently, women often feel that their experiences are just that, *their own* experiences. Nevertheless, there are numerous similarities across women scientists in academia, which indicates a more systemic problem. Thus, in order to address the inequities in the current culture of academic science it will take more than individual change. Efforts must also be made by institutions that employ scientists, as well as at the national level. Some potential responses are described below.

Helping individuals: The US Institute of Medicine has stated that if departments are willing to accept individuals into their training programs, then those departments have an ethical responsibility to provide students with mentoring that will enable them to succeed as professionals (IOM 2002). Whereas long-term improvements in the broader social system of science are desirable, some researchers and professional societies have argued that we must offer women and underrepresented minorities strategies for coping with the present demands of scientific life if we are to increase their participation in science (Sonnert and Holton 1996; Long 2001; AAMC 2002). Such programs might include a type of "mentoring in mass" program (Fischer and Zigmond 2001) in which individuals are exposed to some of the key information that is traditionally communicated primarily through professional networks. This helps to make transparent the informal rules of science and academia and thereby provides access to a more level playing field.

Promoting change at the level of the institution: It is important to educate not only women academic scientists, but also members of the community at large so that the latter may begin to understand and address the forces that result in disparities (Sonnert and Holton 1995; MIT 1999; Long 2001). Recognition of inequities in the system is the first step that institutions can take toward rectifying the situation. Hopkins (2002) was one of the first scholars to do a systemic examination within her school of disparities in the treatment of men and women in the sciences. Those data convinced the administrators at that institution that there was a problem. Remarkably, the institution was willing to publicly acknowledge and commit to addressing the problem. Furthermore, although begun at just one institution, the study eventually led to a multi-institution taskforce to address issues of equity (Rosser 2004).

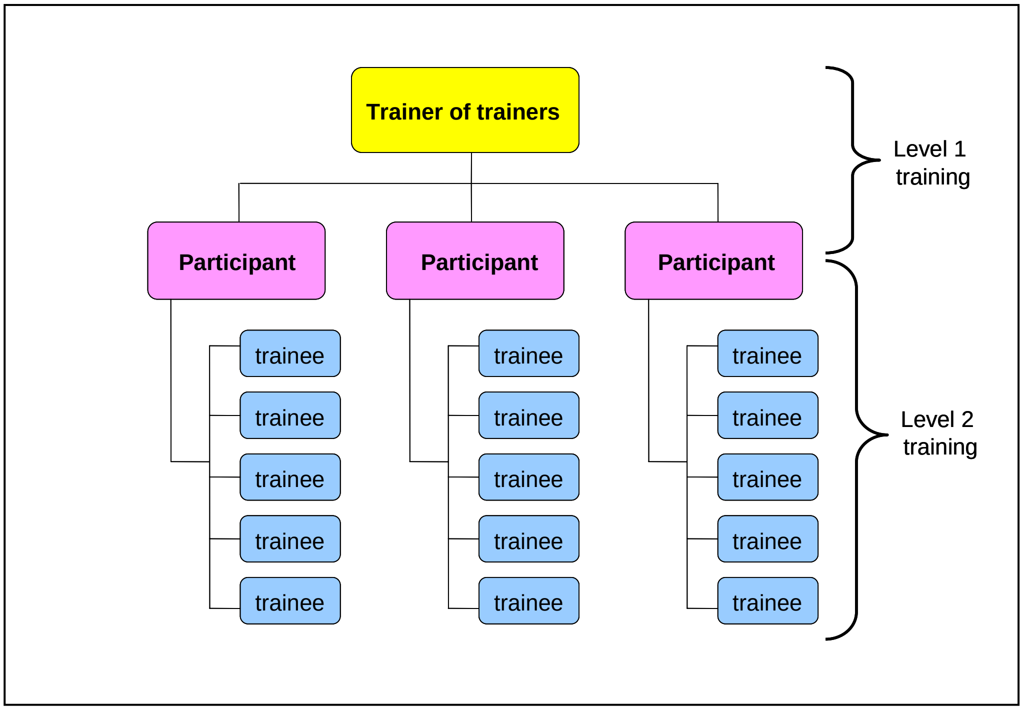
Facilitating change via national policy: Funding agencies such as the National Science Foundation can continue to make available grants for systemic examination of the treatment of women in academia and provide funding to support innovative programs to build a more equitable climate (Rosser 2004; NSF 2005). Scientific societies can also play a role in promoting equity by ensuring that women are included in conferences as speakers, panelists, and session organizers, as well as ensuring that women are represented at more than a token level on a society's board of directors.

2.4 TRAINING THE TRAINER

The *trainer-of-trainers* model is an educational format in which instruction occurs at least two levels: In level 1, the trainer-of-trainer provides instruction to faculty who then, in level 2, provide instruction to their students. This structure is also known as a "cascade model" as the instruction tends to cascade down to the individuals in the lower levels. This is the simplest version of the model. The number of levels could be increased, the constant being that individuals at each level provide instruction to those in the level below. Note that in the trainer-of-trainers model, professional rank is not implied by the hierarchical structure. For example, the "students" could be clinicians, graduate students, or K-12 teachers.

The critical feature of the trainer-of-trainers model is that there is a "multiplier effect" allowing the efforts of a relatively small number of facilitators to disseminate information and skills to a relatively large community (Hayes 2000). Through such a structure, the cost, in terms of money and time away from the job, can be minimized, and the program can be tailored to local needs (Hayes 2000). This educational format has been applied frequently to training projects in the developing world, in-service teacher education, and training of clinical faculty and residents (e.g., see (Sparks 1988; Bax 1995b; Skeff et al. 1997; Hayes 2000; Buck and Cordes 2005). Aside of the risk that the trainers will not implement instruction, the major disadvantage of this model is the potential for a dilution of training as the information is transmitted from one level to another (Bax 1995b; Hayes 2000).

Figure 1. Trainer-of-trainers model



2.4.1.1 Key variables

The literature on variables affecting the success of the trainer-of-trainers programs is thin. Nevertheless, there are some factors that have been identified. These include the selection of facilitators and trainers, as well as aspects of curriculum development and follow-up support. These are discussed in the sections below.

2.4.1.2 Facilitators

Obviously, the individuals who serve as facilitators who train the trainers need to be knowledgeable about the content area they will be teaching, so that the information that they present is accurate and appropriate. However, this is also important because the trainers' impressions of the facilitator's credibility will influence the trainers' confidence in the speaker and value of the material being presented (Bax 1995b; Skeff 1998b; Gunderman et al. 2002).

When possible, it is useful to select facilitators who have had background and experiences similar to the participants (Gelula and Yudkowsky 2003). For example, Skeff has reported that in their trainer-of-trainers program, which serves clinicians, they felt that having respected MDs as facilitators was an important factor in the success of their program (Skeff 1998b). Not only did the MDs have the necessary knowledge base, but they were also perceived as a role model.

It is not enough to be a content expert; effective facilitators also need to have developed their training abilities (Rand et al. 1992; Skeff et al. 1997). If it is not possible to identify someone who is both a content expert and a good instructor, then a combination of individuals with those backgrounds may be desirable.

Additional characteristics that are helpful for facilitators to possess include confidence in their own qualifications and their appropriateness as a facilitator. This shown up as a factor of particular importance in the success of some programs implemented in non-Western cultures, for example, South Africa (Bax 1995b). Enthusiasm is also an important characteristic for promoting and maintaining participants' interest and motivation (Skeff 1998b).

The ***number*** of trainer-of-trainers to be involved in an event generally depends on their knowledge base, the number of participants, the desired amount of interaction, and length of the program. Additionally, even in cases that do not suggest the needs for a second facilitator, their inclusion can still be valuable (Rand et al. 1992). Switching between presenters can help to maintain the interest of the listeners, and it can promote a more focused presentation and minimize monologues by the trainer-of-trainers (Vella 1995). For example, one trainer-of-trainers has commented *"I am much more accountable to the learners when I am teaching in a team of two"* (Vella 1995, p. 15).

2.4.1.3 Participants

Critical to the success of any trainer-of-trainers programs is the selection of appropriate participants. Given that the purpose of any trainer-of-trainers program is to have the participants establish instruction in their local environment, it is essential that the participants understand what will be expected of them. For example, potential participants should be informed that in the trainer-of-trainers program they will (1) gain content on the specified topic (e.g., diabetes), (2) learn how to teach about the topic, and (3) learn how to implement training. They will (4) be expected to return to their organization and provide training (Indian Health Service 1995).

Participants' enthusiasm and commitment to the program goals have been shown to directly affect the success of trainer-of-trainers programs (Sparks 1988). Thus, it can be useful to screen potential participants over the phone to ensure the necessary level of commitment to the goals of the program (Indian Health Service 1995). This helps to ensure that individuals are not attending the program "just because it is available" (Indian Health Service 1995).

The ***number*** of individuals attending the program will directly impact the type and amount of participant interaction with each other and with the facilitator. Vella strongly advocates limiting the number of participants to 8-12 (Vella 1995). However, numerous studies have shown the viability of trainer-of-trainers programs involving many more participants (e.g., see (Hayes 2000; Pololi et al. 2001; Gelula and Yudkowsky 2003). Research has also demonstrated that subsequent implementation of instruction by trainers is more likely to occur when participants attend with someone else from their unit, as that provides an automatic local support group (Skeff et al. 1997; Lee 2004).

With regard to support, institutional support is also a factor in the successful implementation of programs (Indian Health Service 1995; Skeff et al. 1997). Without at least minimal institutional support, trainers will face an uphill battle in their implementation efforts (Skeff et al. 1997). Support could range from encouragement and enthusiasm for the endeavor, to payment of expenses associated with attending the trainer-of-trainers event, to funding and release time for trainers (Indian Health Service 1995).

2.4.1.4 Program duration

Determining the duration of the program involves several decisions: the amount of time per session, the number of sessions, and the interval over which time the sessions are spaced. First and foremost, it is important to consider the amount of change that the program hopes to effect. Generally, the larger or more radical the change that trainers will be expected to implement, the longer the program will require (Vella 1995). Another key variable is the amount of time that participants can be away from their existing responsibilities. For example, taking several days off in a row is often not feasible for clinicians. Thus, trainer-of-trainers programs for such professionals are often 1-2 hr per session (Skeff et al. 1997).

Spaced instruction can be quite effective in that it reinforces ideas over time as well as allows time for practice and reflection between each session. Such formats have been recommended for providing instruction in the responsible conduct of research, either alone, or in combination with a short-term, intensive introduction to research ethics (Fischer and Zigmond 2001; Institute of Medicine 2002).

2.4.1.5 Curriculum

In designing the curriculum there are a number of principles that emerged from the literature on the trainer-of-trainers model. In the sections below, the relevance of these principles to the trainer-of-trainers model is emphasized, however most are part of good educational practice regardless of the setting in which they are applied.

A. Tailor the instruction to the students. Facilitators can minimize their preparation if they use a set curriculum for each group they train. However, the students will be more receptive, and find the instruction more valuable, if the material if it is tailored to their specific backgrounds, interests, and needs (Sparks 1988; Bax 1995a; Bax 1997; Gunderman et al. 2002; Gelula and Yudkowsky 2003). This sort of information on the students could be collected in a pre-conference survey. In the case of multi-day events, interim collection of comments on how the event is progressing can allow the facilitators to make mid-course changes to ensure that the program meets the trainers' needs.

It is also useful for the facilitator to collect from the students examples of typical cases that they (the future trainers) deal with, so that these can be used in class (Bax 1995a; Bax 1997). It is particularly helpful if the facilitator uses the trainers own wording of the case in discussing it in the group; trainers view such examples as more realistic and it helps to convince the them of the relevance of the program to their own situations (Bax 1995a).

B. Be sensitive to the social/cultural norms of the environment in which the training will be implemented. Cultural issues can be a substantial factor in whether trainers attempt, and are successful in, implementing instruction subsequent to their attending the trainer-of-trainers event (Bax 1995b). Because facilitators often come from a different environment than the trainers, they may not be aware of local needs and norms. Without sensitivity to the local culture, the trainers may deem the material as irrelevant. In cases in which the training is being exported from a developed to a developing nation, this can even lead to accusations of cultural imperialism (Indian Health Service 1995).

One way to ensure that the local culture and needs are being addressed is to provide the trainers, as well as other local stakeholders (e.g., administrators), with an opportunity to influence the trainer-of-trainers program and content (Indian Health Service 1995; Hayes 2000). Not only will this ensure program relevance, it will also promote community buy-in to the project (Bax 1997; Hayes 2000), as well as provide additional types of expertise (Boice 1989; Hayes 2000).

Trainers may not have thought much about the social or cultural implications of the program they will establish (Bax 1995b). Thus, in addition to the facilitator gaining information on local practices, it may also be necessary to help the trainer develop awareness of these issues through reflective exercises (Bax 1995b).

C. Promote active learning. Learning is facilitated when individuals interact with the materials rather than just listening passively. Thus, successful trainer-of-trainers programs often use a variety of techniques to promote active learning (Gunderman et al. 2002; Clark et al. 2004). These may involve problem solving or preparing instructional units; the exercises can be undertaken by individuals, or pairs or groups of participants. Regardless, the key feature of such exercises is that the participants are required the participants to interpret and apply the material as opposed to simply reciting ideas learned in the lecture (Bax 1997).

Role playing is a valuable technique for promoting interaction with the subject matter (Skeff et al. 1997). It may be done to provide practice in a skill, to demonstrate different viewpoints, or to problem solve. For example, one way in which this technique has been used effectively in trainer-of-trainers events is to role play a discussion between a trainer and a school administrator regarding the implementation of training. By vocalizing the different perspectives and concerns of the two groups, participants are better equipped to develop successful strategies for implementation (Skeff 1998a).

Another technique that has been shown to be particularly effective in promoting trainer abilities is "*microteaching.*" In this method, trainers practice teaching a small section of the course content that they are to implement. They make their presentation to other participants in the program, and in some cases their presentation is also videotaped. Participants benefit from this exercise in a number of ways: (1) the trainer gets practice teaching, (2) trainers and facilitators provide feedback on the subject's effort, and (3) other trainers can get ideas from watching the practices exhibited by their peers (Bax 1995b; Vella 1995; Gelula and Yudkowsky 2003). In cases in which the participant is videotaped, the recording may provide them with evidence of their own behaviors that they were not previously aware of (Gelula and Yudkowsky 2003). Furthermore, if the group of participants is interdisciplinary, this activity may lead the participants to recognize commonality among the challenges they face and may promote the cross-pollination of ideas across fields (Boice 1989; Gelula and Yudkowsky 2003).

An important caveat about including discussion and group work as an instructional activity is that the exercises may need to be moderated at some level to ensure that all participants have an opportunity to speak. However, the facilitator needs to be aware that class discussion is not a common feature in some cultures (Bax 1997). Moreover, individuals from hierarchical societies may be uncomfortable expressing their views in front of, or contradicting the views of, someone more senior in rank (Bax 1997).

D. Provide time for reflection. The value of include time for reflection in the curriculum is a common theme among studies on the effectiveness of this model (Bax 1997; Hayes 2000; Pololi et al. 2001; Buck and Cordes 2005). It is recommend that this activity be included as a formal part of the schedule, rather than assuming that it will automatically take place during "free time." Reflection provides participants with time to integrate what they have learned into their knowledge base, as well as to do some self-evaluation about their own practices.

E. Teach the trainers how to implement training programs. Trainers may not have had much experience implementing educational programs. Thus, given that the goal of any the trainer-of-trainers program is implementation of training at the local level, trainers should be provided with some instruction in this area. Topics include the basics of how to implement the training, as well as provide the instructional materials necessary to do so (Indian Health Service 1995). Trainers should be informed about issues relating to the course/workshop administration, advertising, logistics, and so forth. Additionally, it may also be valuable to for trainers to know how to find sponsors for their workshops or how to provide Continuing Medical Education (CME) credits (Indian Health Service 1995).

2.4.1.6 Venue

Anecdotal evidence indicates that off-site venues can make a marked contribution to the success of the event. Such locations eliminate many of the distractions of work responsibilities, and also provide a venue for extended interaction among participants, thus promoting the development of a community (Vella 1995; Pololi et al. 2001).

2.4.1.7 Follow-up resources

In order for an effort to be sustained, it is important that the effort not occur in vacuum (Bax 1997). Follow-up activities are valuable ways of reinforcing concepts, ensuring continuing compliance and quality in instruction, and maintaining enthusiasm among the trainers. Activities could include additional programmatic events, coordinated collaborative training efforts among trainers, study groups, distance learning programs, phone calls and emails, (Boice and Makosky 1986; Boice 1989), as well as a facilitator visiting local sites to observe implementation. Indeed, research has demonstrated that implementation is more successful when such visits are included (Vella 1995; Gelula and Yudkowsky 2003).

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3.0 METHODOLOGY AND DATA ANALYSIS

3.1 INTRODUCTION

In Spring 2004, the Survival Skills and Ethics Program conducted a follow-up survey to assess a the impacts of their trainer-of-trainers conference. That survey was designed to serve two purposes: (1) to provide the Program Directors with information that could be used to refine and improve the conference program and curricular materials, and (2) to gather data that the program's funding agency would require in progress reports, data which would also be included in applications for a renewal of funding. The results of that survey formed the basis for the current research project.

3.2 POPULATION SURVEYED

Over the 11 years in which the trainer-of-trainers conference had been offered, 353 individuals from 235 institutions were trained. The sample studied consisted of all individuals who had attended one of the first nine annual trainer-of-trainers conferences, which were offered in 1995 through 2003 (265 persons). In 11 cases the participant could not be contacted, as they had retired or moved to a location that could not be identified. Thus, the number of individuals who were sent a request to participate in the survey was 254. In addition, data from individuals who were *required* by their academic institution or funding agency to attend the conference (21 surveyed, 8 responses) and not selected by the conference directors, were not included in this thesis. Thus, all subsequent calculations in this document are based on an adjusted count of 233 potential respondents to the survey.

Participation in the conference was by application only. Up to 40 individuals per year were selected as participants by the Program Directors, based on the information provided by the participants in their application forms. The application form included questions about prior teaching experience, plans for using information obtained at the conference, the number and rank of the individuals that the applicant would train (Appendix A).

A two-step process was used to select participants. First, the following inclusion criteria were applied. Conference participation was limited to applicants who

a. Agreed to the following three terms: They would (1) attend the entire conference, (2) establish (or significantly improve) a instruction in professional development and/or research ethics within one year of their attendance, and (3) provide information on their evaluations from those courses as well as participate in follow-up evaluations of the conference.
b. Were in faculty or staff positions; postdoctoral fellows were not accepted
c. Would provide training to students, faculty, or staff in research, or research-related, careers
d. Had teaching experience

In the second step of the selection process, preference was given to applicants who

a. Had a detailed plan for how they would use the information gained at the conference
b. Planned larger dissemination efforts
c. Planned to train substantial numbers of students from underserved groups
d. Were at institutions that were research oriented
e. Were attending with a teammate
f. Were affiliated with an institution that had not yet been represented at the trainer-of-trainers conference. (With a few exceptions, only two individuals would be trained from a given institution.)

While applying these criteria, attention was also paid to promoting diversity of gender, rank of individuals to be trained, and discipline. Diversity with regard to race was also promoted, although this was difficult to do, as a question about race was not included on the application form. However, some individuals from underrepresented minority groups indicated that in the 'additional comments' section of their application. With few exceptions, only two persons were accepted from any given institution.

3.3 SURVEY DEVELOPMENT

3.3.1 Survey Objectives

The survey was designed to provide information on four areas of interest: (1) impacts of the conference on the participants, (2) participant implementation of training, (3) barriers to implementation of training, and (4) future Program services that would be helpful to the participant. These areas were chosen to provide data that would help to inform future participant selection, conference schedules, and support activities, as well as to provide outcome data to the Program's funders. However, care was also taken to ensure that the survey was not so long it was burdensome for the subject and thus less likely to be completed.

3.3.2 Survey Content

The survey (Appendix A) went through numerous rounds of revisions, which involved the Program Directors, program staff, an evaluation consultant, and some conference participants who had agreed to pilot test the instrument.

Data were collected on several different topical areas:

1. ***Updated personal information.*** Position; institution; contact information
2. ***Impacts of the conference on the participant.*** Ability to teach survival skills and ethics; their own professional growth; their service on committees related to survival skills and ethics.
3. ***Implementation of training.*** Implementation status; sustainability of the training implemented; nature of the training provided: is participation required, voluntary, or both; data for most recent year in which survival skills and ethics were taught:

year, number of hours of instruction provided, levels and numbers of participants, percentage of participants that were underrepresented minorities and non-citizen nationals; main disciplines of the participants; number of other instructors involved.

4. ***Impact on participants who had already been teaching survival skills and ethics:*** Changes in the number of hours, topics, type and number of participants and of underrepresented minorities.
5. ***Barriers to implementation of training.*** How much of a challenge to implementation was lack of time, funding, materials, participant interest, and/or administrative assistance; discouragement from colleagues and administration; difficulty meeting needs of diverse audience; difficulty recruiting additional instructors (if desired).
6. ***Support for efforts.*** Type, amount, and source of support for their efforts to implement and provide instruction in survival skills and ethics, specifically funding; food; materials (e.g., books); equipment and/or use of equipment; printing and duplication; release time for instructors; space for meeting or instructor offices; support staff and administrative assistance; program promotion and/or advertising. Changes in support that they believe resulted from their attendance at the conference.
7. ***Networking with other participants.*** number of times the participant has been in contact with other conference participants; value of those contacts; type of benefits of continued contact.
8. ***Additional types of support that the participant would find useful.*** New instructional units on survival skills and ethics; alerts to materials available from other sources; assistance in networking; refresher course. If interested in a refresher, what is the optimal duration (in days), the amount they would be able to pay, and their goals for attending.
9. ***Additional comments.*** (an open-ended question)
10. ***Website for linking to the Program's site.*** If the participant had developed a website for their course, would they be willing to let the Survival Skills and Ethics Program's website link to theirs, thus providing visitors to the Program's

website with examples of the type of instruction implemented by conference participants. If so, the URL was requested.

3.3.3 Survey Development

The survey questions were developed with the assistance of Elaine Oliverio, who was then working part time for the Survival Skills and Ethics Program and had coordinated other evaluations of the program. Dr. Jennifer Iriti (University of Pittsburgh Learning Research and Development Center) was a paid evaluation consultant. It was Dr. Iriti who suggested that it might be informative to collect data on unintentional impacts of the conference on the participant.

After the wording of the questions was finalized, the survey instrument was converted to a web-based form. If the participant was to skip a survey question based on their answers to prior questions, the web form was programmed to automatically present the next appropriate question. The program also allowed respondents to save a partially completed survey to finish at a later time.

The survey was comprised of numerical, Likert-type, and open-ended questions, including a space the end of the survey for participants to add additional comments. Participants were able to skip questions they did not wish to answer.

Likert-type questions were used to gauge the respondents' attitudes regarding the impact that the conference had on them, the level of challenge that different conditions imposed on their ability to implement and sustain training, and the extent to which additional types of support from the Survival Skills and Ethics Program would be useful to them. The scales used were selected so as to provide enough sensitivity of measurement so that the results were meaningful, while minimizing subjects' confusion by a large set of options. The available responses to those questions were presented as a series of mutually exclusive web radio buttons. Not applicable (N/A) was a potential response for questions regarding conference impact and challenges faced.

Questions on gender and race were not included in the survey, as that information was known to the Program Directors by virtue of their having met each participant at the conference.

3.3.4 Pilot Testing

The Epidemiology Data Center (EDC) at the University of Pittsburgh hosted the survey on their secure website. That Center is independent of the Survival Skills and Ethics Program and has extensive experience in administering such studies. The on-line form was tested by several of the Survival Skills and Ethics Program staff and by the EDC to ensure that the forms were appearing properly on the screen, and that that the data were being recorded and reported (see below) properly. When staff completed the test forms, they provided answers of the type they anticipated the participants would provide.

Five conference participants were asked to complete the survey. This was done to further test the web survey, and to provide feedback on the clarity of the questions and an estimation of the time that it would take for participants to complete the survey. Minor adjustments to the survey form were made based on the feedback received.

3.4 SURVEY ADMINISTRATION

The formal survey was implemented in early April 2004. The EDC generated a unique username and password for each of conference participants. Each participants was sent a personalized email (Appendix B) asking them to participate in the survey. In that letter, the participant was provided with a URL linking to the survey website, and given their individual username and password so that they could log onto that site. Individuals were informed that their information would be confidential, and that data would be presented only in aggregate, so as not protect the participant's identity. Attached to that email was a copy of the survey, so that participants would know what sort of questions would be asked. This would allow individuals to look through their records for information prior to taking the survey.

Participants were instructed that the survey deadline was 05/21/04. After that date had passed, the Survival Skills and Ethics staff attempted to contact all non-respondents. Over the course of the summer, non-respondents received 3 personalized emails and one telephone call requesting that they complete the survey. The survey was deemed to be as complete as possible on October 14, 2004.

The EDC provided a weekly updated *Microsoft Access* file containing the survey data. The *Access* file was subsequently converted to a *Microsoft Excel* file for analysis. The spreadsheet was arranged with one participant per row, and one column per question. As the results were received, the data were checked for inconsistencies. It was in this way that the unintentional reversal in the coding of the *'yes'* and *'no'* responses to questions 5 and 7 was discovered. (That problem was subsequently corrected.)

3.4.1 Response rate

Individuals who submitted an incomplete survey were included in the overall response rate, however the sample size for the each survey question was adjusted accordingly. The overall rate of return for the survey was 76%, thus providing data on 168 participants.

3.5 DATA ANALYSIS

3.5.1 Classification of disciplines and institutions

Participant responses to the questions about discipline and institution were coded manually, using the following guides:

Discipline: Individuals who worked in a support office that served a range of disciplines at the institution were labeled a "cross-campus." Otherwise, the classification system used by Thompson-Peterson's Educational Services (2004) was used to assign disciplines to one of the following categories:: biological sciences, business, engineering, humanities, medical professions and sciences, physical sciences, and social sciences.

Institution: Institutions were classified based on a slightly modified version of the Carnegie Foundation's *Classification of US Degree-granting Institutions* (2000). In the present study, one additional category was added: research institute. All institutions were assigned to one of the following categories: associate, baccalaureate, international, masters, medical school, research extensive, research intensive, or research institute (**Error! Reference source not found.**).

3.5.2 Types of analyses

SPSS software (version 14.0 for Windows) was used to calculate both descriptive and inferential statistics, and alpha was set to 0.05. Data analysis varied with the type of question, as described below. Data reported are for U.S. participants only, except as noted.

Demographics (nominal data): Chi-square analysis of the number of subjects per group was used to examine correlations between variables (e.g., was rank associated with gender).

Implementation: Extreme outliers, as identified visually from boxplots generated in SPSS, were excluded from the analysis. (The values of the excluded points are noted on the relevant tables.) Mean, standard deviation, and 95% confidence interval were then calculated. Comparisons involving two groups were analyzed using a t-test. Comparisons among more than two groups were analyzed using a one-way ANOVA, followed, when appropriate, with a post-hoc Tukey test.

Conference impacts and challenges to implementation: Responses to these Likert-type questions were treated as a scalar variable. Mean and standard deviation were calculated. Comparisons involving two groups were analyzed using a t-test. Comparisons among more than two groups were analyzed using a one-way ANOVA, followed, when appropriate, with a post-hoc Tukey test.

Comments: Most of the open-ended questions were designed to provide individuals with a mechanism for suggesting responses other than those already listed. Few individuals answered those questions. Their answers were categorized and the overall frequency of the issues reported (e.g., how many participants indicated that they had a need for materials related to grant writing).

3.5.3 Treatment of small groups

Some groups contained less than five subjects, either because of a low response rate or because very few individuals with a given characteristic participated in the conference (e.g., individuals from outside of the United States). Descriptive data are presented for those groups, however, those groups were not included in determinations of statistical significance. All groups containing 5 or more subjects were included in the analysis. However, if the a group was less than 10% of the size of the largest group in the comparison, the data were reanalyzed after exclusion of the small group.

3.5.4 Sustainment of courses

The “sustainment of courses” measure is designed to reflect the percentage of time that a course was sustained in comparison to the total amount of time available since their attendance at the conference. Sustainment of courses was calculated as follows:

1. *Potential years* = Year of survey – year of attendance at the trainer-of-trainers conference + 1.
2. *Actual years* = Most recent year in which instruction was provided - year instruction was implemented + 1.
3. *Course sustainment* = Actual years / potential years x 100.

In calculations 2 and 3, a value of +1 was included in the equation so that the result would be positive (rather than 0) for individuals who had implemented instruction in the same year in which they attended.

As indicated above, the following three main topics of research were addressed in the survey:

1. The extent to which the conference impacted on the participants

2. The characteristics of the training implemented by participants

3. The barriers to implementation that the participants faced

The data analysis plans for research topics are detailed in Table 2 to 4.

Table 2. Analysis of conference impacts

Independent Variables *Dependent Variables* Impacts on participants'…	1 – All participants	2 – Race	3 – Gender	4 – Rank	5 – Discipline	6 – Type institution	7 – Location	8 – Taught before	9 – Teammate	10 - Fellowship
a. …ability to teach survival skills	x	x	x	x	x	x	x	x	x	x
b. …ability to teach ethics	x	x	x	x	x	x	x	x	x	x
c. …awareness of issues	x	x	x	x	x	x	x	x		
d. …own growth	x	x	x	x	x	x	x	x		
Number of comparisons	4	4	4	4	4	4	4	4	2	2

Table 3. Analysis of instruction implemented

Independent Variables / *Dependent Variables*	1 – All participants	2 – Race	3 – Gender	4 – Rank	5 – Discipline	6 – Type institution	7 – Location	8 – Taught before	9 - Teammate	10 - Fellowship
a. Hours of instruction in professional skills	x	x	x	x	x	x	x	x	x	
b. Hours of training in ethics	x	x	x	x	x	x	x	x	x	
c. Number of individuals taught	x	x	x	x	x	x	x	x	x	
d. Percentage of students who are minorities	x	x	x	x	x	x	x	x	x	
e. Percentage of students who are international	x	x	x	x	x	x	x	x	x	
f. Sustainment of instruction	x	x	x	x	x	x	x	x	x	x
Number of comparisons	6	6	6	6	6	6	6	6	6	1

Table 4. Analysis of barriers to implementation

Independent Variables / *Dependent Variables*	1 – All participants	2 – Race	3 – Gender	4 – Rank	5 – Discipline	6 – Type institution	7 – Location	8 – Taught before	9 – Teammate	10 – Fellowship
a. Lack of time	x	x	x	x	x	x		x	x	
b. Lack of funding	x	x	x	x	x	x		x	x	
c. Lack of instructional materials	x	x	x	x	x	x		x	x	
d. Low level of participant interest	x	x	x	x	x	x		x	x	
e. Faculty discouraged efforts	x	x	x	x	x	x		x	x	
f. Senior administration discouraged efforts	x	x	x	x	x	x		x	x	
g. Lack of administrative assistance	x	x	x	x	x	x		x	x	
h. Difficulty meeting needs of diverse audience	x	x	x	x	x	x		x	x	
i. Difficulty recruiting additional faculty	x	x	x	x	x	x		x	x	
Number of comparisons	9	9	9	9	9	9	0	9	9	0

4.0 RESULTS

This chapter is divided into four sections: The first section provides information on two key demographics of the survey respondents – gender and race. Subsequent sections address the main research questions, specifically, the impacts of the conference on the participants, implementation of instruction, and challenges to implementation.

4.1 DEMOGRAPHICS

4.1.1 Gender

More women held the rank of assistant professor (24%) than any other rank (

Table 5). The next largest group of women held the rank of director or coordinator of a support center (20%). In contrast, the rank containing the largest number of men was that of professor (22%), which was followed closely by associate professor (21%). Women were more than twice as likely than men to hold the rank of assistant professor (24% women, 10% men) or lecturer (9% women, 4% men). In contrast, men were 1.8 times more likely to hold the rank of associate professor (12% women vs 21% men), and 1.4 times more likely to hold the rank of professor (16% women, 22% men).

With regard to discipline, men were much more likely than women to work in the field of biological sciences (38% women vs 65% men), whereas women were approximately twice as likely as men to work in the field of medical professions and sciences (17% women vs 8% men). Men were substantially more likely to have received a travel fellowship to support their attendance at the conference (58% men vs 39% women). There were no significant differences in the percentages of men and women who had taught professional development and/or ethics prior to attending the conference.

Table 5. Participant demographics by gender

Variable	Subjects (n)	Group	Women (n)	Men (n)	Chi-square
--	166	All U.S.	94	72	--
Race	166	Non-minority	82	69	ns
		Minority	12	3	
Rank	164	Director or coordinator, support center	18	8	**≤ 0.05***
		Lecturer	8	3	
		Assistant professor	22	7	
		Associate professor	11	15	
		Full professor	15	16	
		Director of graduate studies	2	4	
		Dean, vice president, or provost	14	12	
		Chair	2	7	
Discipline	166	Biological sciences	36	47	**≤ 0.025***
		Medical professions and sciences	16	6	
		Engineering, physical sciences	5	3	
		Social sciences, humanities	6	2	
		Cross-campus	31	13	
Institution	166	Research – intensive	53	38	ns
		Research – extensive	13	8	
		Medical school	12	4	
		Master's + baccalaureate + associate	10	9	
		Research institute	6	3	
Experience	150	Taught before	40	35	ns
		Did not teach	42	33	

Team	166	Single	111	11	ns
		Team	40	4	
Fellowship	140	No fellowship	49	25	**≤ 0.025***
		Received fellowship	31	35	
Statistical significance was determined by chi square analysis. Alpha was set to 0.05.					

4.1.2 Race

Approximately 10% of respondents were under-represented minorities (**Table 6**). Those respondents had a markedly different profile than that of non-minorities. Twenty percent of the minority respondents were men, as opposed to 86% of non-minorities. Slightly less than half of minorities who responded to the survey held administrative positions at the dean's level or higher. In contrast, non-minorities were distributed across the ranks such that no one group exceeded 20% of respondents. Most minorities served disciplines across their campus, whereas most non-minority respondents held positions in the biological sciences. There were minorities affiliated with each class of institution, although most minorities were from research intensive (36%) or master's level institutions (36%). In contrast, most non-minority respondents were affiliated with research-intensive institutions (86%). Lastly, minorities were less likely than non-minorities to have received a fellowship.

Table 6. Participant demographics by race

Variable	Subjects (n)	Group	Non-minority (n)	Minority (n)	Chi-square
--	166	All U.S.	151	15	--
Gender	166	Women	82	12	ns
		Men	69	3	
Rank	164	Director/coordinator, support center	29	0	**≤ 0.05***
		Lecturer	25	1	
		Assistant professor	28	3	
		Associate professor	9	0	
		Full professor	6	0	
		Director of graduate studies	23	3	
		Dean, vice president, or provost	19	7	
		Chair	10	1	
Discipline	166	Biological sciences	80	3	**≤ 0.05***
		Medical professions and sciences	19	3	
		Engineering, physical sciences	18	0	
		Social sciences, humanities	6	2	
		Cross-campus	37	7	
Institution	166	Research – intensive	86	5	ns
		Research – extensive	20	1	
		Medical school	23	3	
		Master's + baccalaureate + assoc.	14	5	
		Research institute [x]	8	1	
Experience	150	Taught before	69	6	ns
		Did not teach	70	5	
Team	166	Single	111	11	ns
		Team	40	4	
Fellowship	140	No fellowship	66	8	**0.045***
		Received fellowship	64	2	

Statistical significance was determined by chi square analysis. Alpha was set to 0.05.

4.2 IMPACTS OF CONFERENCE ON PARTICIPANTS

Four potential impacts of the conference were assessed: (1) ability to teach professional development, (2) ability to teach ethics, (3) awareness of issues, and (4) personal growth. For each of the survey questions, participants were instructed to rate the extent to which the conference impacted them using the following scale: 1 (no impact) to 6 (substantial impact).

4.2.1 Ability to teach professional development

Most participants (78%) rated the conferences' impact on their ability to teach professional development as a '5' or '6' (Table 7). The mean response was 5.1 ± 0.9. None of the variables examined had a statistically significant effect.

Table 7. Ability to teach professional skills

Variable	Group	n	Mean	Standard deviation	P value
--	All U.S.	145	5.1	0.9	--
Race	Non-minority	130	5.1	1.0	0.614
	Minority	15	5.0	0.8	
Gender	Women	79	5.0	1.1	0.146
	Men	66	5.2	0.8	
Rank	Director or coordinator, support center	23	5.1	0.9	0.970
	Lecturer	7	5.3	1.1	
	Assistant professor	25	5.1	1.0	
	Associate professor	25	5.2	1.1	
	Full professor	28	4.9	0.9	
	Director of graduate studies	6	5.3	0.8	
	Dean, vice president, or provost	20	5.2	1.0	
	Chair	9	5.2	0.8	
Discipline	Biological sciences	78	5.3	0.9	0.136
	Medical professions and sciences	17	4.9	1.1	
	Engineering, physical sciences [x]	7	4.9	0.9	
	Social sciences, humanities [x]	6	4.5	1.6	
	Cross-campus	35	5.0	0.9	
Institution	Research – intensive	78	5.1	0.9	0.732
	Research – extensive	20	5.4	0.7	
	Medical school	23	5.1	1.2	
	Master's	10	5.1	0.6	
	Research institute	8	5.0	0.8	
	Baccalaureate and associate [x]	6	5.0	1.3	
	International [y]	3	4.0	1.7	
Experience	Taught before	69	5.0	1.0	0.097
	Did not teach	64	5.3	0.9	

Teammate	Single	105	5.1	0.9	0.893
	Team	40	5.1	1.0	
Fellowship	No fellowship	63	5.0	0.9	0.075
	Received fellowship	60	5.3	1.0	

Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. [X]Indicates that the group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test. [Y]Denotes that the group *was not* included in the calculation of *p* for a given variable. Alpha was set at 0.05.

4.2.2 Ability to teach ethics

Seventy eight percent of participants rated the conferences' impact on their ability to teach ethics as a '5' or a '6,' and the overall mean rating was 5.0 ± 0.9 (Table 8). Men rated the conference as having a larger impact on their ability to teach ethics than did women (5.2 ± 0.8 vs 4.9 ± 1.0, respectively). None of the other variables examined were statistically significant.

Table 8. Ability to teach ethics

Variable	Group	n	Mean	Standard deviation	P value
--	All U.S.	157	5.0	0.9	--
Race	Non-minority	141	5.0	1.0	0.914
	Minority	16	5.1	0.7	
Gender	Women	88	4.9	1.0	**0.018***
	Men	69	5.2	0.8	
Rank	Director or coordinator, support center	24	5.0	0.9	0.501
	Lecturer	10	5.2	0.9	
	Assistant professor	26	4.8	0.9	
	Associate professor	25	4.9	1.1	
	Full professor	30	5.1	1.0	
	Director of graduate studies	6	5.5	0.5	
	Chair	9	5.4	0.7	
	Dean, vice president, or provost	25	5.0	1.0	
Discipline	Biological sciences	81	5.2	0.9	0.066
	Medical professions and sciences	18	4.9	0.9	
	Engineering, physical sciences [x]	7	4.9	1.1	
	Social sciences, humanities [x]	7	4.4	1.0	
	Cross-campus	42	4.8	1.0	
Institution	Research – intensive	84	5.0	0.9	0.564
	Research – extensive	19	5.3	0.8	
	Medical school	25	5.0	1.0	
	Master’s	11	4.6	1.0	
	Research institute	10	5.0	0.6	
	Baccalaureate and associate	8	4.9	1.1	
	International [y]	5	4.2	2.2	
Experience	Taught before	74	5.0	0.9	0.307
	Did not teach	68	5.1	1.0	

Teammate	Single	115	5.0	1.0	0.908
	Team	42	5.0	0.9	
Fellowship	No fellowship	71	5.1	0.9	0.903
	Received fellowship	62	5.1	1.0	

Variables consisting of two groups were analyzed with a t-test; an ANOVA was used for variables containing more than 2 groups. [X]Indicates that the small group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test. [Y]Denotes that the group *was not* included in the calculation of p for a given variable. Alpha was set at 0.05.

4.2.3 Awareness of issues

Most participants (81%) rated the conference's impact on their awareness of issues related to professional development and ethics as a '5' or '6,' and the overall mean was 5.2 ± 0.9 (Table 9). Participants who had *not* taught professional development and ethics prior to attending the conference reported a greater increase in awareness than did individuals who had previously provided instruction on these topics (5.3 ± 0.9 vs 5.0 ± 0.9, respectively). None of the other variables examined were statistically significant.

Table 9. Awareness of issues

Variable	Group	n	Mean	Standard deviation	P value
--	All U.S.	166	5.2	0.9	--
Race	Non-minority	150	5.2	0.9	0.512
	Minority	16	5.3	0.7	
Gender	Women	93	5.2	1.0	0.907
	Men	73	5.2	0.9	
Rank	Director or coordinator, support center	27	5.1	1.1	0.528
	Lecturer	11	4.9	1.0	
	Assistant professor	29	5.2	0.8	
	Associate professor	26	4.9	1.2	
	Full professor	30	5.4	0.8	
	Director of graduate studies	6	5.3	1.0	
	Chair	9	5.3	0.7	
	Dean, vice president, or provost	26	5.2	0.6	
Discipline	Biological sciences	83	5.2	1.0	0.557
	Medical professions and sciences	21	5.0	0.9	
	Engineering, physical sciences	8	5.4	0.5	
	Social sciences, humanities	7	4.7	0.8	
	Cross-campus	45	5.2	0.7	
Institution	Research – intensive	90	5.2	0.9	0.235
	Research – extensive	20	5.6	0.7	
	Medical school	26	4.9	1.1	
	Master's	11	5.1	0.8	
	Research institute	11	5.0	0.6	
	Baccalaureate and associate	8	5.5	0.5	
	International [x]	6	4.2	2.1	
Experience	Taught before	74	5.0	0.9	**0.037***
	Did not teach	75	5.3	0.9	

Teammate	Single	123	5.1	1.0	0.269
	Team	43	5.3	0.7	
Fellowship	No fellowship	74	5.1	0.9	0.381
	Received fellowship	66	5.3	0.9	
Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. [X]Indicates that the small group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test. Alpha was set to 0.05					

4.2.4 Professional growth

The majority of participants (71%) rated the conference's impact on their own professional growth as a '5' or a '6' (Table 10). The mean rating was 4.9 ± 1.1. None of the variables examined were statistically significant.

Table 10. Participants' own professional growth

Variable	Group	n	Mean	Standard deviation	P value
--	All U.S.	165	4.9	1.1	--
Race	Non-minority	149	4.9	1.1	0.256
	Minority	16	5.2	0.8	
Gender	Women	93	5.0	1.1	0.122
	Men	72	4.8	1.0	
Rank	Director or coordinator, support center	27	4.8	1.1	0.913
	Lecturer	11	5.1	0.7	
	Assistant professor	29	4.8	1.4	
	Associate professor	26	4.8	1.1	
	Full professor	30	5.1	0.9	
	Director of graduate studies	5	5.2	0.8	
	Chair	9	5.0	0.9	
	Dean, vice president, or provost	26	4.8	1.1	
Discipline	Biological sciences	83	4.8	1.2	0.727
	Medical professions and sciences	20	5.0	1.3	
	Engineering, physical sciences	8	4.9	1.0	
	Social sciences, humanities	7	4.7	1.0	
	Cross-campus	45	5.1	0.8	
Institution	Research – intensive	90	4.9	1.1	0.660
	Research – extensive	20	5.1	1.1	
	Medical school	25	4.6	1.0	
	Master's	11	4.8	0.6	
	Research institute	11	5.1	0.7	
	Baccalaureate and associate [x]	8	4.8	1.4	
	International [x]	5	3.6	1.5	
Experience	Taught before	74	4.7	1.1	0.117
	Did not teach	75	5.0	1.1	

Teammate	Single	122	4.9	1.1	0.359
	Team	43	4.8	1.1	
Fellowship	No fellowship	73	4.9	1.1	0.908
	Received fellowship	66	4.9	1.1	

Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. [x]Indicates that the small group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test. Alpha was set to 0.05.

4.2.5 Additional impacts of the conference

The survey included an open-ended question regarding any additional impacts of the conference that the participants experienced. Those data are reported in Table 11.

Table 11. Additional conference impacts

Improved abilities to mentor and advise students and/or faculty (6)
Provided instructional materials (2)
Led to the development of new units/events:
a course/program for undergraduates (3)
graduate orientation sessions (1)
mentoring for new faculty (1)
ethics instruction in special events (1)
ethics material for distance education (1)
Facilitated networking with other professionals/colleagues (2)
Increased leadership skills and interest in topic of leadership (2)
Increased commitment (1)
Reinforced what I was already doing (1)
Understand WHY [participant's emphasis] topic areas important (1)
Provided new ideas on what to implement (1)
Able to better oversee ethical issues at institution (1)
Encouraged colleagues to care about mentoring (1)
Became a better teacher (1)
Provided understanding of HOW [participant's emphasis] areas can be taught (1)

4.2.6 Relative strength of conference impacts

There was little variability among the overall means of the 4 impacts of the conference (Table 12). Moreover, the distribution of responses for each variable were quite similar (

Figure 2). Nevertheless, there were two patterns that became evident when comparing across impacts: (1) the group "social sciences and humanities" consistently exhibited the lowest mean conference impact, and (2) research extensive universities consistently had the highest mean impact.

Table 12. Comparison of mean conference impacts

Impact	Mean	Std
Ability to teach professional development	5.1	0.9
Ability to teach ethics	5.0	0.9
Awareness of issues	5.2	0.9
Professional growth	4.9	1.1

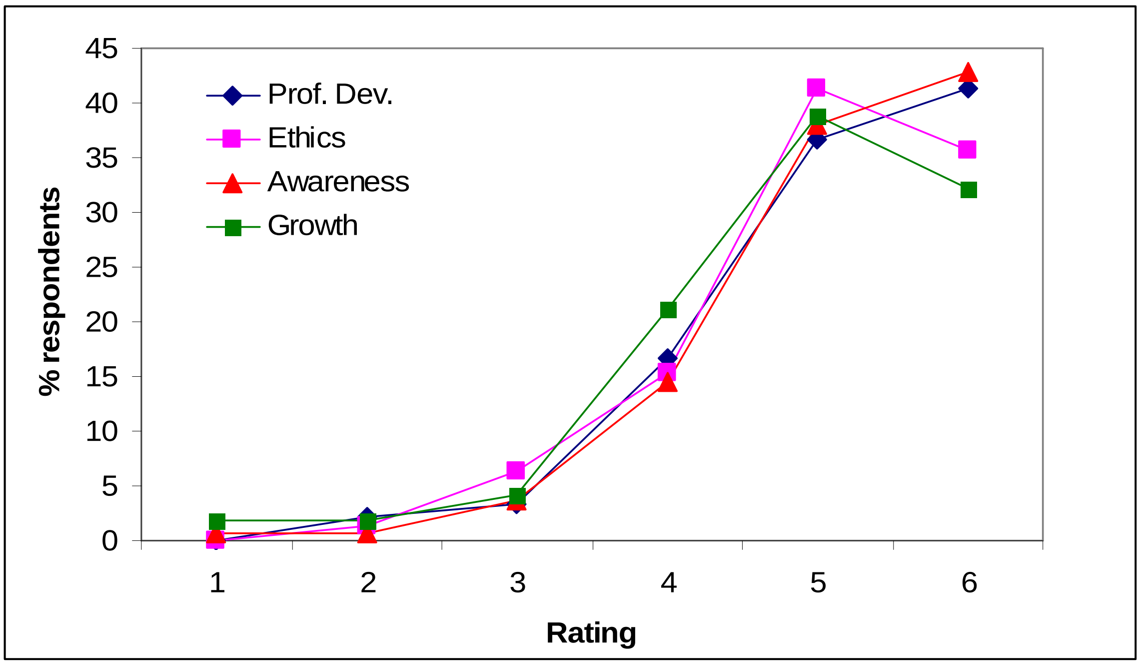

Figure 2. Mean conference impacts: Frequency of responses

4.3 INSTRUCTION IMPLEMENTED BY PARTICIPANTS

4.3.1 Training in professional development

The amount of training in professional development implemented by participants varied widely. Responses ranged from 0 hr to 2630 hr in a given year. Excluding extreme outliers, the mean was 23 hr (Table 13). Women provided significantly more instruction in professional development than did men (27 ± 27 hr vs 19 ± 18 hr, respectively). None of the other variables examined were statistically significant.

Table 13. Professional development training implemented

Variable	Group	N	Lower bound 95% CI	Upper bound 95% CI	Mean	Std	P value
--	All U.S.	127	19	27	23	23	--
Race	Non-minority	120	19	27	23	24	0.804
	Minority	7	8	33	21	14	
Gender	Women	65	20	34	27	27	**0.047***
	Men	62	14	23	19	18	
Rank	Director/coordinator, support center	20	13	30	16	17	0.861
	Lecturer	7	-2	59	29	33	
	Assistant professor	23	15	30	20	17	
	Associate professor	22	7	35	14	32	
	Full professor	19	14	26	16	13	
	Director of graduate studies [x]	4	-6	47	14	16	
	Chair	9	4	32	12	18	
	Dean, vice president, or provost	21	16	44	21	31	
Discipline	Biological sciences	70	17	25	21	16	0.483
	Medical professions and sciences	15	2	46	24	39	
	Engineering, physical sciences	7	2	29	15	15	
	Social sciences, humanities [x]	4	15	65	38	24	
	Cross-campus	30	16	34	26	29	
Institution	Research – intensive	74	17	28	23	24	0.499
	Research – extensive	16	14	40	27	24	
	Medical school	17	9	23	16	13	
	Master's	8	8	44	26	21	
	Research institute	7	12	20	16	4	
	Baccalaureate and associate [x]	5	-20	92	36	45	
	International [y]	5	19	27	23	24	

Experience	Taught before	62	19	32	26	26	0.153
	Did not teach	65	15	25	20	15	
Teammate	Single	91	19	28	23	22	0.714
	Team	36	12	31	22	17	
Fellowship	No fellowship	53	18	32	25	26	0.206
	Received fellowship	57	16	24	20	15	
Extreme outliers, as identified by visual inspection a boxplot, were excluded from the calculations; those values were 2,650 and 550. Means were analyzed using a t-test (for variables with 2 groups) or one-way ANOVA (for variables with >2 groups). Alpha was set to 0.05.							

4.3.2 Implementation of training in ethics

The amount of ethics training provided by a participants ranged from 0 to 1515 hr over the course of a year. After exclusion of extreme outliers the mean was 14 hr of instruction in ethics (Table 14). Of the variables examined, only the institutional class was found to be statistically significant. Participants at research extensive institutions provided more than twice the amount of ethics instruction than did participants at research intensive, medical, or master's level institutions. None of the other variables were statistically significant.

Table 14. Ethics training implemented

Variable	Group	N	Lower bound 95% CI	Upper bound 95% CI	Mean	Std	P value
--	All U.S.	131	12	17	14	16	--
Race	Non-minority	122	11	17	14	16	0.995
	Minority	9	6	22	14	11	
Gender	Women	70	12	18	15	14	0.516
	Men	61	9	18	13	18	
Rank	Director/coordinator, support center	4	6	21	13	5	0.134
	Lecturer	11	7	45	26	28	
	Assistant professor	21	8	30	19	24	
	Associate professor	20	7	17	12	11	
	Full professor	23	6	14	10	10	
	Director of graduate studies [x]	4	6	21	13	5	
	Chair	9	5	15	10	7	
	Dean, vice president, or provost	21	7	20	13	14	
Discipline	Biological sciences	73	10	16	13	15	0.498
	Medical professions and sciences	13	6	24	15	15	
	Engineering, physical sciences	8	-2	20	9	13	
	Social sciences, humanities [x]	3	-16	59	21	15	
	Cross-campus	32	11	25	18	20	
Institution	Research – intensive [a]	77	10	15	12	10	**0.000***
	Research – extensive [a b c]	19	15	45	30	30	
	Medical school [b]	17	7	13	10	6	
	Master's [c]	8	2	12	7	6	
	Research institute	7	1	29	15	15	

	Baccalaureate and associate [x]	3	-9	35	13	9	
	International [y]	3	-26	50	12	15	
Experience	Taught before	70	11	17	14	11	0.729
	Did <u>not</u> teach	61	10	20	15	20	
Teammate	Single	96	11	16	14	15	0.407
	Team	35	9	23	16	19	
Fellowship	No fellowship	57	11	21	16	20	0.269
	Received fellowship	54	9	15	12	11	
One extreme outlier, as identified by visual inspection a boxplot, was excluded from the calculations; that value was 1515.							

4.3.3 Number of individuals trained

The number of students trained in the courses established by participants varied widely, from 1 to 746 individuals (Table 15). Excluding extreme outliers, the mean was 84 ± 111 students. Significant differences among groups were noted for the variables gender, rank, discipline, experience, and fellowship. On average, women trained approximately 60% more students than did the men. Likewise, participants who had taught professional development and/or ethics prior to the conference also trained approximately 60% more students than those who did not have experience. Participants who did not receive a conference fellowship trained roughly 50% the number of students as did participants who had received travel support. Finally, participants who provided training across their campus taught more than 50% times the number of students than did their counterparts in other disciplines.

Table 15. Number of students trained

Variable	Group	N	Lower bound 95% CI	Upper bound 95% CI	Mean	Std	P value
--	All U.S.	143	66	103	84	111	--
Race	Non-minority	133	64	100	82	105	0.519
	Minority	10	-9	250	120	181	
Gender	Women	76	72	132	101	129	**0.038***
	Men	67	44	85	64	83	
Rank	Director/coordinator, support center [a]	22	71	207	139	153	**0.005***
	Lecturer	11	37	147	92	82	
	Assistant professor	26	22	75	49	65	
	Associate professor	23	9	89	49	92	
	Full professor [a b]	24	24	56	40	39	
	Director of graduate studies [y]	4	-64	298	117	114	
	Chair	9	-9	178	84	121	
	Dean, vice president, or provost [b]	22	75	197	136	138	
Discipline	Biological sciences [a]	77	42	76	59	73	**0.000***
	Medical professions & sciences [b]	16	17	56	36	37	
	Engineering, physical sciences [c]	8	14	33	24	11	
	Social sciences, humanities [x]	4	-46	237	95	89	
	Cross-campus [a b c]	36	121	229	174	160	
Institution	Research – intensive	84	62	114	88	118	0.449
	Research – extensive	19	33	131	82	101	
	Medical school	19	24	83	54	61	
	Master’s	8	-27	201	87	137	
	Research institute	8	22	271	146	149	
	Baccalaureate and associate [x]	5	32	50	41	7	
	International [x]	4	66	103	84	111	

Experience	Taught before	72	76	138	107	132	**0.015***
	Did not teach	71	42	81	62	81	
Teammate	Single	103	66	114	90	121	0.262
	Team	40	44	96	70	81	
Fellowship	No fellowship	60	82	151	116	133	**0.017***
	Received fellowship	62	41	90	66	95	
One extreme outlier, as identified by visual inspection a boxplot, and was excluded from the calculations; the value excluded was 746.							

4.3.4 Sustainment of courses

On average, participants provided instruction over 68% of the time elapsed since their attendance at the conference (Table 16). Eighty percent of respondents indicated that their courses were ongoing, whereas 10% reported of respondents reported that their courses ended, and the remaining 10% indicated that they had not implemented instruction.

Individuals who received travel fellowships sustained their courses for a longer time than did the individuals who did not receive a travel fellowship (77 ± 23 vs 62 ± 26, respectively). A trend was evident in regard to rank: sustainment increased with each increase in academic rank, up to the level of chair at 86% sustainment. After that, course sustainment dropped to the level of 58% for deans, vice presidents, and provosts.

Table 16. Sustainment of courses

Variable	Group	n	Mean %	Standard deviation	P value
--	All U.S.	146	68	27	--
Race	Non-minority	136	69	26	0.374
	Minority	10	61	34	
Gender	Women	78	67	25	0.703
	Men	68	69	28	
Rank	Director or coordinator, support center	23	58	25	0.179
	Lecturer	11	61	27	
	Assistant professor	27	65	28	
	Associate professor	23	71	28	
	Full professor	25	73	25	
	Director of graduate studies [x]	4	81	10	
	Chair	9	86	11	
	Dean, vice president, or provost	23	58	25	
Discipline	Biological sciences [c]	78	71	25	0.642
	Medical professions and sciences	17	62	35	
	Engineering, physical sciences	8	63	24	
	Social sciences, humanities [x]	5	69	42	
	Cross-campus [c]	36	65	26	
Institution	Research – intensive	84	70	25	0.555
	Research – extensive	20	67	31	
	Medical school	20	67	28	
	Master's	9	61	37	
	Research institute	7	79	14	
	Baccalaureate and associate [x]	6	53	27	
	International [y]	3	25	22	
Experience	Taught before	73	69	28	0.637
	Did not teach	72	67	25	

Teammate	Single	104	69	26	0.653
	Team	42	67	28	
Fellowship	No fellowship	64	62	26	**0.002***
	Received fellowship	60	77	23	

Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. Special attention was given to groups containing low numbers of subjects (i.e., <5 subjects, or <10% the number of subjects in the largest group for a given variable). [X]Indicates that the small group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test. [Y]Denotes that the small group *was not* included in the calculation of p for a given variable. An asterisk indicates statistical significance ($p<0.05$).

4.3.5 Minority students

Overall, 19 ± 26% of the students taught by participants were minorities (Table 17). Minority participants trained a much larger percentage of minority students than did non-minorities (74 ± 35% vs 15 ± 20%). In addition, the percentage of minority students trained at master's level institutions was substantially greater than those trained at other types of institutions. Participants who had *not* received a travel fellowship taught nearly twice the percentage of minority students than did individuals who received a travel fellowship.

Table 17. Percent of students who were underrepresented minorities

Variable	Group	n	Mean (%)	Standard deviation	P value
--	All U.S.	141	19	26	--
Race	Non-minority	131	15	20	**0.000***
	Minority	10	74	35	
Gender	Women	76	21	28	0.330
	Men	65	17	23	
Rank	Director or coordinator, support center	19	34	35	0.124
	Lecturer	11	22	30	
	Assistant professor	27	13	20	
	Associate professor	23	12	18	
	Full professor	24	26	30	
	Director of graduate studies [x]	4	15	7	
	Chair	9	19	32	
	Dean, vice president, or provost	22	16	21	
Discipline	Biological sciences	77	19	26	0.593
	Medical professions and sciences	16	12	12	
	Engineering, physical sciences	7	13	14	
	Social sciences, humanities	5	20	34	
	Cross-campus	34	24	32	
Institution	Research – intensive [a]	79	14	19	**0.008***
	Research – extensive	20	19	28	
	Medical school	19	26	31	
	Master's [a]	9	47	44	
	Research institute	8	12	7	
	Baccalaureate and associate [x]	6	28	38	
	International [y]	2	1	1	
Experience	Taught before	71	20	27	0.716
	Did not teach	70	18	25	

Teammate	Single	102	18	25	0.260
	Team	39	23	27	
Fellowship	No fellowship	61	23	31	**0.012***
	Received fellowship	58	12	15	

Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. [X]Indicates that the group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test. [Y]Denotes that the small group *was not* included in the calculation of *p* for a given variable. An asterisk indicates statistical significance ($p<0.05$).

4.3.6 International students

On average, 15% of individuals taught by U.S. participants were international students (Table 18). Participants who held positions at the deans level and higher taught a greater percentage of internationals than did participants holding other ranks. In addition, participants who had experience teaching professional development and ethics prior to their attendance at the taught a larger percentage of minorities than did those without teach experience.

Table 18. Percent of students trained who were international students

Variable	Group	n	Mean (%)	Standard deviation	P value
--	All U.S.	137	15	16	
Race	Non-minority	127	16	16	0.082
	Minority	10	7	11	
Gender	Women	72	13	16	0.111
	Men	65	18	16	
Rank	Director or coordinator, support center [a]	18	10	12	**0.026***
	Lecturer	11	18	17	
	Assistant professor	26	12	19	
	Associate professor	22	13	14	
	Full professor	23	13	14	
	Director of graduate studies [x]	4	19	9	
	Chair	9	13	14	
	Dean, vice president, or provost [a]	22	27	18	
Discipline	Biological sciences	76	13	15	0.300
	Medical professions and sciences	15	12	15	
	Engineering, physical sciences	7	20	27	
	Social sciences, humanities	5	19	21	
	Cross-campus	32	20	17	
Institution	Research – intensive	78	16	15	0.817
	Research – extensive	19	12	21	
	Medical school	18	15	15	
	Master's	9	14	17	
	Research institute	8	22	18	
	Baccalaureate and associate [x]	5	14	19	
	International [y]	1	25	0	
Experience	Taught before	70	18	16	0.054
	Did not teach	67	13	16	

Teammate	Single	100	16	17	0.296
	Team	37	13	15	
Fellowship	No fellowship	59	14	17	0.449
	Received fellowship	57	16	16	

Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. [X]Indicates that the small group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test. [Y]Denotes that the small group *was not* included in the calculation of *p* for a given variable. An asterisk indicates statistical significance ($p<0.05$).

4.4 FACTORS AFFECTING IMPLEMENTATION

Participants were provided with a list of potential challenges to implementation. They were asked to rate the extent to which each item was a challenge for them, using a scale of 1 = *none*, 2 = *small*, 3 = *substantial*, 4 = *moderate*, 5 = *insurmountable*.

4.4.1 Dedicated time

The mean rating of a lack of dedicated time as a barrier to implementation of training was 3.4 ± 0.8, which falls within the range of *"moderate"* to *"substantial"* impacts (Table 19.). There was little variation of means among the different variables considered: ratings ranged from 3.0 to 3.9. None of the comparisons reached the level of statistical significance.

Table 19. Lack of time as a barrier to implementation

Variable	Group	n	Mean	Standard deviation	P value
--	All U.S.	162	3.4	0.8	--
Race	Non-minority	149	3.3	0.8	0.063
	Minority	13	3.8	0.9	
Gender	Women	90	3.4	0.9	0.365
	Men	72	3.3	0.8	
Rank	Director or coordinator, support center	25	3.2	0.8	0.403
	Lecturer	11	3.0	0.8	
	Assistant professor	29	3.6	0.8	
	Associate professor	25	3.5	0.7	
	Full professor	31	3.3	1.0	
	Director of graduate studies	6	3.3	0.8	
	Chair	9	3.1	0.9	
	Dean, vice president, or provost	24	3.4	0.8	
Discipline	Biological sciences	82	3.4	0.8	0.084
	Medical professions and sciences	22	3.4	0.9	
	Engineering, physical sciences	8	3.4	0.7	
	Social sciences, humanities	7	4.0	0.6	
	Cross-campus	41	3.1	0.8	
Institution	Research – intensive	91	3.3	0.8	0.507
	Research – extensive	20	3.5	0.9	
	Medical school	25	3.3	0.9	
	Master’s	10	3.4	0.5	
	Research institute	8	3.5	0.8	
	Baccalaureate and associate	8	3.9	0.8	
	International [x]	6	3.8	0.4	
Experience	Taught before	75	3.3	0.8	0.386
	Did <u>not</u> teach	73	3.4	0.8	

Teammate	Single	118	3.3	0.8	0.266
	Team	44	3.5	0.9	
Fellowship	No fellowship	71	3.3	0.7	0.578
	Received fellowship	65	3.4	0.9	
Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. [X]Indicates that the group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test.					

4.4.2 Funding

The mean rating of lack of funding as a barrier of implementation was 2.7 ± 1.2 (Table 20.). Minorities indicated that a lack of funding was a significantly greater challenge than did non-minorities (3.4 ± 1.0 vs 2.6 ± 1.2, respectively). In addition, participants who received conference fellowships indicated that funding was less of a barrier to implementation than did those who had paid their own expenses (2.4 ± 1.1 vs 2.9 ± 1.2, respectively).

Table 20. Lack of funding as a barrier to implementation

Variable	Group	n	Mean	Standard deviation	P value
--	All U.S.	155	2.7	1.2	--
Race	Non-minority	144	2.6	1.2	**0.045***
	Minority	11	3.4	1.0	
Gender	Women	87	2.8	1.2	0.360
	Men	68	2.6	1.1	
Rank	Director or coordinator, support center	23	3.0	1.1	0.704
	Lecturer	11	2.3	0.9	
	Assistant professor	29	2.6	1.3	
	Associate professor	23	2.7	1.0	
	Director of graduate studies	6	2.7	0.8	
	Full professor	28	2.7	1.4	
	Chair	9	2.4	1.0	
	Dean, vice president, or provost	24	2.8	1.2	
Discipline	Biological sciences	79	2.5	1.1	0.309
	Medical professions and sciences	20	2.9	1.3	
	Engineering, physical sciences	8	2.9	1.1	
	Social sciences, humanities	6	3.0	1.3	
	Cross-campus	40	2.9	1.1	
Institution	Research – intensive	86	2.7	1.1	0.346
	Research – extensive	20	2.9	1.3	
	Medical school	25	2.7	1.0	
	Master's	8	2.4	1.2	
	Research institute	8	2.0	1.1	
	Baccalaureate and associate	8	3.3	1.5	
	International [x]	6	3.0	1.4	
Experience	Taught before	70	2.6	1.0	0.701
	Did not teach	72	2.6	1.3	

Teammate	Single	111	2.6	1.2	0.552
	Team	44	2.8	1.1	
Fellowship	No fellowship	70	2.9	1.2	**0.016***
	Received fellowship	62	2.4	1.1	
Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. ^{X}Indicates that the small group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test.					

4.4.3 Availability of curricular materials

The overall mean rating of a lack of instructional materials as a challenge to implementation was 1.8 ± 0.9 (Table 21.). None of variables reached the level of statistical significance. Nine participants responded to the open-ended question regarding what types of new or additional curricular materials they would like to have (Table 22). Most of the requests (67%) were for resources for teaching about the responsible conduct of research.

Table 21. Lack of materials as a barrier to implementation

Variable	Group	n	Mean	Standard deviation	P value
--	All U.S.	143	1.8	0.9	--
Race	Non-minority	134	1.8	0.9	0.803
	Minority	9	1.9	1.1	
Gender	Women	81	1.8	0.9	0.294
	Men	62	1.9	0.8	
Rank	Director or coordinator, support center	22	1.8	0.9	0.162
	Lecturer	10	1.3	0.5	
	Assistant professor	29	1.8	0.8	
	Associate professor	23	1.7	0.6	
	Full professor	25	1.9	1.1	
	Director of graduate studies	6	1.3	0.5	
	Chair	8	2.0	0.8	
	Dean, vice president, or provost	18	2.2	0.9	
Discipline	Biological sciences	75	1.9	0.9	0.152
	Medical professions and sciences	20	1.7	0.7	
	Engineering, physical sciences	8	1.4	0.5	
	Social sciences, humanities [x]	5	1.2	0.4	
	Cross-campus	34	2.0	1.0	
Institution	Research – intensive	80	1.7	0.8	0.071
	Research – extensive	20	1.7	1.0	
	Medical school	22	1.9	0.7	
	Master’s	7	2.0	1.0	
	Research institute	8	1.9	1.0	
	Baccalaureate and associate [x]	6	2.8	1.5	
	International [x]	4	2.5	1.3	
Experience	Taught before	65	1.8	0.8	0.449
	Did not teach	68	1.9	0.9	

Teammate	Single	104	1.8	0.8	0.693
	Team	39	1.9	1.0	
Fellowship	No fellowship	65	1.8	0.9	0.934
	Received fellowship	57	1.9	0.9	
Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. [X]Indicates that the small group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test.					

Table 22. Additional materials desired by participants

Topic for which materials were desired	**Respondents (n)**
Ethics case studies	3
Writing course	2
Ethical issues in authorship	1
Ethical issues in data management	1
Material on grant writing	1
Scientific integrity (in general)	1
Supplemental resources for participants	1

4.4.4 Student interest

The overall mean rating of a lack of participant interest as a challenge to implementation was 2.1 ± 1.0 (Table 23.). Lack of student interest was a significantly larger barrier for men than for women (2.4 ± 1.0 vs 1.9 ± 1.0, respectively). It was also a greater barrier for international participants than for participants from any other type of institution.

Table 23. Lack of student interest as a barrier to implementation

Variable	Group	n	Mean	Standard deviation	P value
--	All U.S.	153	2.1	1.0	--
Race	Non-minority	141	2.1	1.0	0.606
	Minority	12	2.3	1.1	
Gender	Women	84	1.9	1.0	**0.002***
	Men	69	2.4	1.0	
Rank	Director or coordinator, support center	25	2.5	1.1	0.369
	Lecturer	11	2.2	0.9	
	Assistant professor	28	1.9	1.0	
	Associate professor	23	2.0	1.0	
	Full professor	26	2.0	1.0	
	Director of graduate studies	6	2.3	0.8	
	Chair	9	1.8	0.7	
	Dean, vice president, or provost	23	2.3	1.2	
Discipline	Biological sciences	76	2.1	0.9	0.094
	Medical professions and sciences	20	2.4	1.1	
	Engineering, physical sciences	8	1.9	1.0	
	Social sciences, humanities	6	1.2	0.4	
	Cross-campus	41	2.2	1.2	
Institution	Research – intensive	85	2.1	1.0	0.672
	Research – extensive	20	1.9	0.9	
	Medical school	23	2.3	1.1	
	Master's	8	2.0	1.1	
	Research institute	9	2.4	1.2	
	Baccalaureate and associate	8	1.9	1.1	
	International [x]	5	3.2	0.8	
Experience	Taught before	71	2.1	1.0	0.790
	Did <u>not</u> teach	73	2.1	1.0	

Teammate	Single	111	2.1	1.0	0.914
	Team	42	2.1	1.1	
Fellowship	No fellowship	69	2.1	1.1	0.796
	Received fellowship	60	2.1	1.0	

Variables consisting of two groups were analyzed using a t-test; an ANOVA was used for variables containing more than 2 groups. [X]Indicates that the small group *was* included in the analysis of means; re-analysis of the data after excluding this group did not change the final outcome of the statistical test.

4.4.5 Faculty discouraged efforts

Participants indicated a low level of discouragement from the faculty (Table 24). Overall, the mean rating of discouragement from faculty as a barrier to implementation was 2.0 ± 1.1. None of the variables examined reached the level of statistical significance.