Modeling Effective Research Ethics Education in Graduate International Collaborations: A Learning Outcomes Approach

A Framework Paper by The Council of Graduate Schools
Modeling Effective Research Ethics Education in Graduate International Collaborations: A Learning Outcomes Approach

A Framework Paper
by
The Council of Graduate Schools

This paper informed the development of an active Request for Proposals that was issued on April 30, 2012 (http://www.cgsnet.org/ckfinder/userfiles/files/CGS_EESE_RFP.pdf). Proposals are due August 15, 2012.

This paper is based on work supported by a grant from the National Science Foundation (NSF#1135345). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.
CONTENTS

Introduction ........................................................................................................................................3

I. Project Background ...............................................................................................................................4
   A. Programs for Graduate Education in Research and Scholarly Integrity ........................................4
   B. A Gap in Current Research Ethics Programs: International Collaborations ...............................5
   C. The Role of the Graduate School in Effecting a Systems Approach to Graduate Education in Research Integrity and Research Ethics ........................................6

II. A "Learning Outcomes" Approach to Assessment ..........................................................................7
   A. What are learning outcomes in graduate education, and why are they valuable ..........................7
   B. What role will learning assessment play in this project? .............................................................9

III. What types of skills, knowledge and training are needed? A Brief Review of Relevant Research and Scholarship ........................................................................................................10

IV. Conclusion and Next Steps ..............................................................................................................13

Notes ..................................................................................................................................................14

Appendix A, “Sample Learning Outcomes for Research Ethics Education in International Collaborations” .................................................................................................................................16

Works Cited .........................................................................................................................................20
The last decade (2001-2011) has seen major changes in U.S. graduate education in two areas. First, a growing number of U.S. universities are developing explicit research ethics programs for graduate students across a range of STEM disciplines. The Council of Graduate Schools (CGS) has supported this growth through initiatives funded by the National Science Foundation (NSF) and the Office of Research Integrity (ORI). Program development has also been catalyzed by recent requirements issued by NSF and the National Institutes of Health (NIH), though the most robust of these programs go beyond what is federally required in terms of objectives, content, delivery methods, and scale. Second, international research and educational collaborations between U.S. institutions and other institutions abroad are growing in number and providing graduate students with exciting opportunities and new challenges. CGS has researched this growth through member surveys on joint degrees, dual degrees, and certificate programs as well as through survey and focus group research funded by a recent NSF-funded grant on the factors that inhibit or promote successful graduate international collaborations in STEM fields, as documented in *Joint Degrees, Dual Degrees, and International Research Collaborations* (CGS, 2010).

While universities are actively engaged in both kinds of activities, more institutional attention is needed to address the ethical issues U.S.-based students and researchers face when participating in international collaborative research and educational programs. Early-career scientists and engineers must be prepared to conduct research and mentor others in a highly international enterprise. The future success of most U.S.-trained scientists and engineers will likely require that they understand the professional expectations for researchers in the U.S., know how to develop global networks, and have special skills and heightened awareness to meet the challenges of conducting research in international contexts. Especially important will be the skills and awareness to navigate situations that go beyond understanding of compliance guidelines as when, for example, international research partners have different policies and expectations on data sharing, authorship, and other areas of research practice, or when effective communication with international colleagues is required to avoid and resolve conflicts regarding intellectual property.

Supported by a grant from the National Science Foundation (NSF#1135345), CGS is conducting a project that will result in institutional models for preparing graduate students to confront the broad range of ethical issues that typically arise in international S&E research and educational collaborations. In the *Request for Proposals* distributed to CGS member institutions on April 30, 2012, we invite institutions to submit proposals that address issues of research ethics and research integrity encountered in science and engineering (S&E) research collaborations (including research collaborations and exchanges as well as joint or dual degree programs). The selection criteria encourage these institutions to also address one or both of two priority areas: 1) those faced by graduate students conducting field research in international settings, and 2) those that international graduate students frequently encounter when studying in U.S. programs.

The project takes an innovative, “learning outcomes” approach to supporting the education
and development of graduate students. Learning Outcomes, a concept developed and refined in a large body of Scholarship on Teaching and Learning (SoTL), are explicit statements of generic skills, abilities, and disciplinary competencies that a student is expected to have acquired as a result of successfully completing a course, a program, or other activities including co-curricular experiences. Through the research and educational activities of the project, CGS seeks to engage faculty, experts, and universities in defining the discrete knowledge, skills, and behaviors that are especially valued in the subsequent careers of scientists and engineers in their fields, and in using these desired outcomes to develop curricular content, to assess student understanding, and to improve educational programs. Such an approach will make it possible to address a well-documented gap in understanding the outcomes of international research experiences, and improve our knowledge about the effectiveness of research ethics education in an international context.

This project is intended to enhance the U.S. S&E graduate community's understanding of the effectiveness of different approaches to integrating research ethics education into international collaboration and of integrating international issues into research ethics programs. The project will result in three types of resources: 1) five model sets of "learning outcomes" that identify research ethics skills and abilities for graduate students in international collaboration, addressing issues typical of different disciplinary and international collaborative contexts; 2) at least five "case studies" that describe how these outcomes are being used to evaluate and enhance graduate research ethics education and graduate international collaborations; and 3) an online repository of graduate learning outcomes for international collaborations. A CGS template for developing learning outcomes will be shared with U.S. universities and offered for broad consideration by other universities' international collaborations, along with a preliminary framework for incorporating a learning outcomes approach into graduate education.

This paper provides a general discussion of the background for the project, the STEM needs to which it responds, and a review of literature on current relevant activities.

I. Project Background

A. Programs for Graduate Education in Research and Scholarly Integrity

The project builds on the results and recommendations from four prior CGS activities. These include two prior NSF-funded projects in the areas of research ethics (NSF #DGE-052781) and international collaborations (NSF #0841399); a multi-year project funded by the Office of Research Integrity, the Project for Scholarly Integrity (PSI), to develop comprehensive, multi-disciplinary graduate education programs in research ethics and integrity; and a Global Summit of university leaders convened by CGS in 2008 on the topic of research ethics where participants discussed aspects of institutionalization and program structure.

For nearly a decade, CGS has worked with U.S. universities to enhance the preparation of graduate students for the ethical challenges and responsibilities of scholarship and research. Since 2003, we have granted sub-awards to 22 universities (and worked with an additional 44 affiliate universities and colleges) to create graduate RCR education programs and resources. Two best practice guides document the results of prior projects. Graduate Education for the Responsible Conduct of Research (CGS, 2006) reports on the results of a two-year CGS contract (2004-06) with the Office of Research Integrity (ORI) to develop and test interventions and assessment strategies at 10 institutions for the training of graduate students from the behavioral
and biomedical sciences in the responsible conduct of research. *Best Practices in Graduate Education for the Responsible Conduct of Research* (CGS, 2009a) reports on results of a two-year grant to CGS (2006-08) from NSF to develop interdisciplinary programs in research ethics for students in science and engineering at eight institutions. The Project for Scholarly Integrity (PSI) built on the recommendations and lessons learned from both of these prior initiatives. Beginning in 2007, with funding from ORI, CGS worked first with an advisory committee and subsequently with six U.S. universities to define and develop a framework for a comprehensive institutional approach to research and scholarly integrity that was subsequently pilot-tested by six universities. A monograph on the PSI is forthcoming, summer 2012.

The research activities for these projects helped CGS to identify areas of need and opportunity that are addressed in the current project. Data from the PSI confirmed findings from the earlier NSF-funded project that there is a gap between the way program faculty perceive the training they are providing to students in the areas of research and scholarly integrity and the training that students say they are receiving. Overall, S&E students receive information through a wide range of required and elective activities and resources: online training modules; required and elective courses in the program or graduate college; existing program courses incorporating research ethics issues (e.g., research methods); orientation programs; workshops; seminars and speaker series; etc. But nearly four of every five (78%) of individuals responding to a PSI survey on behalf of 240 graduate programs or departments reported that students in their programs receive information on research ethics issues from advisors and mentors, whereas 50% or less reported that students receive this information through other means, such as coursework, workshops, or online and print materials. (When we analyzed data for Physical Sciences, Engineering, and Mathematics separately, respondents reported that students were three times more likely to receive information through advising and mentoring than through any other modality.)

However, graduate students report receiving much of the information they need about research ethics and integrity from sources other than their advisors and mentors and, depending on their supervisor, do not always find the mentoring relationship to provide them with adequate guidance on issues research integrity. In the context of international research, some students describe "trial by fire" situations in which collaborative or field research with international partners or in another country involves challenges that have been unanticipated by students' research advisors in courses, supervision, or a grant project design. These findings indicate a need to provide graduate students with multiple touch points for research integrity education. A second and more promising finding in the PSI is that students are eager to receive this preparation. The institutions that participated in the PSI as awardees and affiliates indicate that there is a strong interest on the part of students in research integrity education that is delivered both centrally and in departments, especially when these opportunities are tied to a students’ professional development as a researcher.

B. A Gap in Current Research Ethics Programs: International Collaborations

As promising as prior CGS research ethics programs have been, and as important as graduate schools have proven in fostering programs that are both embedded in disciplines and scaled across campuses, these programs have not typically addressed the ethical and research integrity issues that students and researchers confront in international collaborative research. In discussions with PI's on NSF-funded Integrative Graduate Education and Research Traineeship
modeling effective research ethics and education in graduate international collaborations (IGERT) and partnerships for international research and education (PIRE) programs, university leaders in the global summit series, and deans in CGS PSI workshops and annual meeting sessions, we have identified several reasons for this gap. First, much of the national dialogue about comprehensive research ethics programs has been influenced by national (federal) mandates for RCR training. Issues specific to international collaboration have not received sufficient attention. Second, international collaborations often place additional time and financial burdens on PhD students, which make it difficult for these students to pursue coursework or other activities outside their program of research. Third, universities have struggled to meet the needs of international students studying in U.S. programs.

When discussion of research ethics and international issues have arisen in prior CGS projects, university leaders have reported that concerns about stigmatizing international students and a lack of awareness of strong national models have prevented them from moving forward. Promising models have developed for addressing research ethics needs of international students and US domestic students in international collaborative research settings, and section III of this paper surveys activities in this area. But better integration into graduate education requires a more comprehensive approach to institutionalization. While prior studies have produced valuable resources that can be shared among institutions, this project seeks to uncover where comparative study of the effectiveness of such programs both within and across institutions is needed and where ongoing inter-institutional dialogue would be beneficial.

C. The Role of the Graduate School in Effecting a Systems Approach to Graduate Education in Research Integrity and Research Ethics

Graduate school-led research ethics and RCR programs have evolved into a hybrid design that informs the proposed project structure and the model of cultural change that underlies it. Resources and activities are distributed between centralized sources, on the one hand, and program sources on the other, including coursework and in-lab activities. Such a distributed model of research ethics education provides students with both general as well as field-specific skills and knowledge. This hybrid design also supports sustainability and furthers campus integration. Graduate schools play an important role in fostering interdisciplinary, cross-campus collaboration in research ethics education. Prior CGS projects provide examples of how graduate schools have effectively brought multiple campus units and program faculty together with complementary areas of expertise. Graduate deans have provided strong leadership and support in assessing vulnerabilities, identifying needs, and supporting the faculty-led development of curricula and activities targeted to meet those needs and vulnerabilities.

This hybrid design under strong graduate school leadership is supported by research that calls for closer attention to the role of institutional environments in supporting, or hindering, education and training in research integrity. In medical fields, the need to address the institutional systems that foster integrity is well established. In 2002, an influential National Academies Institute of Medicine report endorsed an “open-systems model” to conceptualize the dynamic relationship between different elements of a research organization that contribute to an overall climate of integrity. The knowledge, attitudes, and behaviors of its members are strongly tied to distinct aspects of organizational structure, such as its missions, goals, and strategies for promoting research integrity, and the processes it uses to support those goals through strong leadership, communication, and socialization of members around this issue (IOM, 2002). Focusing on units of institutional culture that extend to other S&E fields, Melissa Anderson has
argued that greater attention must be given to the ways in which labs and research groups socialize and reinforce the ethical behaviors of their members, including students and senior scientists (Louis et al., 2007). CGS projects have been successful because they leverage the support of graduate schools, which have the unique ability to promote culture change at the broader organizational level as well as within departments and programs where research and research training are taking place. Our experience working with 66 universities as awardees and partners across three national projects suggests that this comprehensive, integrated approach to research ethics education is also the most effective approach in terms of gaining the broad faculty input necessary to ensure relevance and meet student needs.

II. A "Learning Outcomes" Approach to Assessment

A. What are learning outcomes in graduate education, and why are they valuable?  

Learning Outcomes. As described in the introduction, a learning outcomes approach to graduate education focuses on what students are expected to do as a result of their experience in a course, extracurricular training experience, or in the graduate program as a whole. Two broad objectives for many graduate programs are for students to develop as professionals in the field and to master the research skills of the discipline. At the level of the graduate program, directors of graduate programs or faculty assessment committees take the lead in developing outcomes for students in consultation with their colleagues and the graduate school. At the course level, faculty will ideally take the lead in developing learning outcomes that are appropriate to their course goals and consistent with broader learning outcomes at the program level. At both levels, it is especially important that graduate learning outcomes take into account the differences in disciplines or fields of knowledge.

Of course, learning outcomes have sparked debate and disagreement at the graduate level because these differences have not always been reflected in attempts to map a “general” model onto graduate degree programs. As a result, many faculty have resisted the application of learning outcomes to graduate-level work. We agree with criticisms of current efforts to define "student learning outcomes" for graduate degrees in a matter analogous to the way these have been used in undergraduate learning assessment. However, we believe the proposed approach answers the core objections in such criticisms that (a) learning outcomes should reflect the diversity of learning objectives in field-specific knowledge characteristic of graduate education, and (b) it is best when faculty take a lead position in the definition of appropriate outcomes based on those objectives.

As described in the recently revised edition of Assessment and Review of Graduate Programs (CGS 2011), while traditional pedagogy focuses on educational “inputs”—such as the quality of the teaching provided to students—a learning outcomes approach seeks to assess the outcomes of curricular and other training experiences and then uses this evidence to improve teaching and curricula. Student learning outcomes generally have these characteristics:

- Outcomes are focused on students, typically beginning with the phrase, “By the time they graduate or complete their course of study, students should be able to/are expected to…”
- Outcomes incorporate action verbs to describe what students are expected to do to demonstrate they have achieved faculty expectations for learning. For example:
By the time they graduate or complete their course of study, students should be able to identify a research problem whose solution makes an important contribution to the field.

By the time they graduate or complete their course of study, students are expected to present scholarly papers at local, regional, and national/international conferences.

- Outcomes avoid such verbs as “to understand” and “to be familiar with” because an outcome should describe what students are expected to do, which may be observed, rather than to indicate their understanding or familiarity, which can be inferred through observations but not directly observed or documented. (CGS 2011)
- Faculty make explicit to students the desired outcomes of their course of study, a practice that helps students become conscious about the value and relevance of the educational experience and capable of monitoring their own progress towards learning objectives.

Program Assessment. Once outcomes have been established, they become useful means by which faculty can assess the extent to which a given program of study enables students to achieve the outcomes. Typical of graduate program assessment, generally, an assessment plan includes the evidence to be collected to assess each outcome, the frequency of collection of evidence, a process for interpreting the evidence and identifying logical program improvements based on the evidence, and when and to whom the results of an evaluation will be reported.

There are many possible forms of evidence faculty can use, including graduate placement information, evaluation rubrics from final defenses, number of student publications, results of certain exit interview questions, and results of surveys of recent graduates. While not all of these considerations may be relevant or feasible in the assessment of international collaborations, some general principles in the use of outcomes in program assessment may apply in considering their potential for advancing the goals of this project. For example, as faculty discuss what evidence should be incorporated in their assessment plan, some guidelines they may consider include:

- The evidence should be meaningful. That is, it should be appropriate to the outcomes it is intended to assess. Evidence should allow faculty to come to a judgment as to how effectively the program has enabled students to achieve each outcome.
- The evidence should be manageable. The process of collecting and analyzing the evidence should be practicable and realistic. If it is not, it is unlikely to be done.
- Evidence should be appropriate to the goal of outcomes assessment: for faculty to make a reasonable judgment about the effectiveness of their programs and have appropriate information to guide decisions about how to improve programs. Sometimes faculty assume that they should bring the same evidential rigor to outcomes assessment that they expect of publishable research in their disciplines. That kind of rigor may not be necessary for achieving the goal of assessment and may indeed become an obstacle to faculty in creating and implementing an assessment plan that is feasible. Faculty should be encouraged to consider both qualitative and quantitative evidence.
- Generally, outcomes assessment plans are weighted toward relatively direct evidence of what students do rather than relatively indirect evidence, such as surveys. (CGS 2011)

Assessment of graduate program outcomes provides the groundwork for increased responsiveness and agility in making needed programmatic changes—and for faculty to make
such changes in ways that are agile and responsive to changes in the environment—and for making those changes based on evidence rather than anecdote. Second, the use of outcomes can also provide one critical form of accountability to various stakeholders. While in general graduate assessment they may be useful in providing required information to accrediting agencies, in STEM international collaborations they can help to ensure that students’ needs are being met in ways that complement the institutions’ broader efforts to comply with mandates for research ethics training. They can also potentially be used to support discussions of tangible outcomes, or value-added, from international collaborative research. When outcomes are defined and assessed by program faculty in response to specific graduate, STEM educational objectives, such assessment can also increase faculty participation in broader institutional discussions of the objectives and mission of the graduate program as a whole. Finally, provided that the program’s outcomes are communicated to students, outcomes assessment can give students a clearer picture of faculty expectations and goals for them as participants in the program.

B. What role will learning assessment play in this project?

Learning assessment is an integral component of this project. The assessment model builds on extensive prior experience working with U.S. universities in the domains of research ethics and international collaborations. We learned through the PSI and two prior CGS projects in research integrity that one of the most significant obstacles to building effective programs is a lack of methods of demonstrating the effectiveness of research ethics education. Without evidence of such effectiveness, faculty are unlikely to be receptive to models for integrating such education into S&E graduate programs or to support students’ participation in activities offered by central campus units.

Approaches to learning assessment range from testing of objective knowledge of standards (e.g., the Collaborative Institutional Training Initiative, or CITI), testing of metacognition skills, short-term pre- and post-testing of student knowledge after to discrete activities such as workshops and seminars, and measuring ethical decision-making skills (some of this important work has been funded with CGS sub-awards on research ethics projects).

One challenge of coordinating comparative institutional learning assessments is that the learning objectives of programs differ so greatly by institution and within institution, by program and campus unit. This project takes a different approach, which we believe addresses this challenge. A learning outcomes approach recognizes the fact that objectives differ across research ethics programs and may vary according to discipline, providing flexibility to faculty and program directors to define outcomes appropriate to their educational goals. Faculty should therefore take the lead role in the definition of discipline-specific graduate learning outcomes. However, strong faculty input and inter-institutional dialogue are also needed for promising models to be recognized as effective and as having wider applicability across S&E programs. By identifying and measuring a diverse range of outcomes, institutional awardees and affiliates will contribute to broader national discussion of concrete tools appropriate to measure the value of international experience and the effectiveness of research ethics education, generally. The learning outcomes approach is also consistent with, and can be enhanced by, the institutional “systems model” of ethics education described above. As individual programs develop specific learning outcomes, graduate schools can address students’ need (and desire) for multiple touchpoints to serve their professional development, and ensure that multiple campus units work together to share and pool resources and information.
In December 2011, we convened an Advisory Committee consisting of graduate deans, assessment experts, experts in research ethics, and PI’s of NSF grants with international components to provide input on a template, “Sample Learning Outcomes for Research Ethics Education in International Collaborations.” The revised template includes examples of graduate outcomes (knowledge, skills, and professional attitudes) in three broad areas: Cultural Contexts, Research Practices, and Ethical Frameworks. The template (included as Appendix A) is not intended to be prescriptive but rather to inspire original thinking among participating institutions and STEM collaborators about research ethics outcomes appropriate to their fields and/or projects. Included with the template that accompanies the Request for Proposals are suggestions for how the template might be used.

In the short term, one of the primary uses envisioned is the development and/or enhancement of research ethics curricula specific to the needs of graduate students in STEM disciplines and STEM research collaborations. In the longer term, such outcomes may complement other means to measure the effectiveness of these curricula. Demonstration of the effectiveness of research ethics education has potential implications for achieving the broader faculty and institutional support necessary for the scale-up and sustainability envisioned in this proposal. Because of the unique challenges and needs of international collaborations and the discrete skills required for success in them, international collaborations provide an ideal laboratory for the kind of interdisciplinary, cross-institutional dialogue that would be needed for broader efforts both to define graduate learning outcomes and to measure the effectiveness of research ethics education.

III. What types of skills, knowledge and training are needed? A Brief Review of Relevant Research and Scholarship

The past several years have seen a number of important conferences, workshops and publications on the topic of research integrity and research integrity education in an international context. Many research institutes and organizations with strong investments in the globalization of science have focused attention on research integrity issues that arise in international collaboration (Burroughs Wellcome Fund & Howard Hughes Medical Institute 2006; CGS 2010; NAS, NAE, & IOM, 2011), while experts in research integrity and research ethics have explored institutional, cultural or legal factors that shape researchers’ awareness of, and views about, ethical issues in research (Anderson and Steneck 2011; CGS, forthcoming 2012).

The publications and reports that resulted from the discussions above include examples of the ethical and legal issues that emerge in international collaborations in STEM fields. Some of these vary by discipline: in engineering, for example, cultural differences may result in different engineering codes and design and manufacturing processes; in biomedical and stem cell research, cultural differences may result in disagreements regarding permissible methods of producing stem cell lines and working with human embryos. As was highlighted at the recent workshop organized by the National Academy of Sciences, National Academy of Engineering, and the Institute of Medicine, international collaborations may also bring to light differences in the ways in which research is organized and conducted: misunderstandings may arise when differences in the relationship between government, industry, and universities are not anticipated or well understood, and institutions, researchers, and graduate students in different countries may have conflicting views about enlisting industry representatives in collaborative projects. In past CGS best practice projects including the Project for Scholarly Integrity, the Graduate...
International Collaborations Project, and the 2008 Global Summit on Research Ethics and Scholarly Integrity. CGS identified areas of particular vulnerability in international collaborations in Science and Engineering: Collaborative Research, \textsuperscript{11} Conflicts of Interest and Commitment and Intellectual Property, \textsuperscript{12} Publication Practices and Responsible Authorship (including plagiarism), \textsuperscript{13} and Resources and Materials: Access, Sharing and Exchange.\textsuperscript{14}

New attention has also been given to differences in global graduate education systems that should be taken into account when designing research integrity education that involves graduate students from different nations and cultures. In Anderson and Steneck’s edited volume, \textit{International Research Collaborations: Much to be Gained, Many Ways to Get in Trouble}, an essay co-written by 9 authors representing 7 countries explores the ways in which political and academic institutions shape the socialization of students as researchers. Some differences among countries relate to resources or professional status: access to materials and technology; the number of academic positions open to doctoral students; the pressure on students to publish research outcomes; and the degree to which corruption affects research and its rewards (Anderson et al., 2011). On the smaller unit of the program or laboratory, there are also differences in social norms that shape the practices of research: how strongly these units stress group work and achievement over and above individual success; the hierarchy or balance of power among members of the research team; the nature of the relationship between supervisors and students; and the extent to which student contributions to research are recognized and rewarded. Such factors shed light on the varying expectations that faculty advisors and students may bring to the lab or the field when they engage in collaborations with institutional partners.

In some cases, national perspectives on research practice may also be related to different national approaches to (or lack of) graduate education for research integrity and the responsible conduct of research. Plagiarism, for example, may be an accepted practice in some countries or not clearly defined, a problem that has led some researchers to recommend innovative approaches for addressing the needs of students who may not be prepared for the serious consequences of plagiarism in the U.S. context (Heitman and Litewka, 2010; Newberry et al., 2011).

The variety of national approaches to research integrity education was one of the topics explored at CGS’s 2008 Global Summit on Graduate Education, “Scholarly Integrity and Research Ethics in Global Context.” Summit participants, graduate deans and other university leaders from 10 countries, exchanged information about their national and institutional contexts for research integrity as well as best practice recommendations. While participants did not aim to come to a consensus on what approach is best for fostering research integrity, they agreed that it would be desirable for graduate schools in different countries to establish common frames of reference that recognize the value of both educational approaches, depending upon the objectives and areas of need (CGS 2009b, p. 132).\textsuperscript{15}

In graduate international collaborations, supervising faculty and their host institutions are not always prepared to address questions about appropriate content and pedagogy to ensure students are able to manage ethical challenges that arise. How can graduate programs help students make ethical, informed decisions when they encounter research policies that differ or are unevenly enforced? And how can faculty and other teachers of RCR and research ethics education most effectively teach core values underlying research integrity when an internationally diverse group of students may interpret what constitutes “responsibility” or “professionalism” differently? As noted by various contributors to the essay by Anderson et al., Chinese students may see it as their responsibility to follow without question the directions of
their supervisors, whereas Japanese students often view their role as one of maintaining harmony within their research units (Anderson et al., 2011). In the U.S. context, on the other hand, the authors also note that “the openess and competition characteristic of the system can foster modes of interaction that may be seen as inappropriate in some other national contexts” (187). Such varied characteristics may lead students to have different reactions to RCR materials and pedagogies that emphasize skills such as transparency or directness in communication, or that place the burdens of ethical responsibility with the individual researcher or student. The challenge of defining appropriate skills and content knowledge for graduate students, and making them relevant to both domestic and international students, is among several of the topics discussed in the next section.

Learning outcomes for graduate students in international research contexts are also beginning to receive some attention (Abt & Associates, 2011; Nerad and Blumenfeld, 2011; Sadrozinski, 2005). The development of social and intercultural skills needed for international research, for example, was a focus of discussion at a 2011 workshop organized with support from NSF by the Center for Innovation and Research in Graduate Education (CIRGE). There, education researchers, scientists, and experts on international collaboration met to develop a research agenda for international experiences in STEM education. One recommendation from the workshop report is that future outcomes studies should evaluate not only the outcomes of collaborative research, but also the relationships built over the course of the collaboration (Nerad and Blumenfield, 2011). The ability to build professional and research networks encompasses other skills that may directly affect a student’s ability to conduct research responsibly: learning how to build trust, communicate effectively, and appreciate cultural differences among researchers and the diverse environments in which research is conducted. Participants in the CIRGE workshop recommended a number of frameworks for assessing intercultural competencies, such as the Intercultural Development Inventory (IDI).

At the same time, the CIRGE workshop brought together different viewpoints about the extent to which frameworks for assessing student outcomes of international research experience should emphasize intercultural competence, technical skills, or scientific outcomes (32). The current project uses the learning outcomes approach to foster more explicit disciplinary and interdisciplinary discussion of how graduate international experiences develop social skills that enhance the practice and outcomes of collaborative research on the one hand, and discipline-specific, scientific knowledge and skills on the other.

Finally, a number of projects recently conducted with support from NSF’s Ethics Education in Science and Engineering (EESE) program have addressed both skill sets, resulting in promising curricular models that seek to prepare graduate students for ethical challenges in international research. At the University of Massachusetts, Amherst, for example, the Science, Technology and Society (STS) Initiative is piloting training modules that address topics such as “Workplace Ethics in Transnational Contexts” and “Transnational Conduct,” each with specific learning objectives. Similarly, an EESE project developed by researchers at Texas Tech University has produced a set of learning objectives for a specific subset of graduate students—international students in engineering—which take into consideration factors such as language barriers, various stages of acculturation, and cultural expectations or lack of preparation that may affect a student’s ability to understand the ethical and professional norms of U.S.-based engineering research. The learning objectives for the web-based modules focus on ethical codes and their purpose, as well as areas of RCR (conflicts of interest, intellectual property and plagiarism, and data integrity); and professional duties, such as understanding competence in
engineering and understanding the consequences for human life and welfare of professional incompetence (Newberry et al., 2009). Finally, taking an approach that focuses on ethical deliberation and decision-making, Brown University is collaborating with the Indian Institute for Technology and Zhejiang University in China to conduct a project on ethical awareness in international collaborations that will result in two research papers, a curriculum based on case studies, and a website that makes available resources developed through the project.

These focused projects make it possible to take into account needs that are specific to certain fields (engineering) or regions (U.S. partnerships with Indian and Chinese institutions), and based on different approaches to research ethics education (RCR and ethical deliberation). They also serve as helpful reminders that any broad-based repository of Learning Outcomes will need to take into account the variety of the contexts in which they may be piloted.17

IV. Conclusion and Next Steps

Scientists and engineers today work in a highly collaborative international environment. Ensuring that researchers are equipped with the understanding and the skills to effectively navigate the ethical issues that arise when collaborating across national borders is an essential aspect of both graduate international collaborations and research ethics education programs. Furthering this objective, as well as addressing the needs of international students studying in U.S. programs and those of graduate students conducting field research abroad, are all encompassed by a broader goal of fostering throughout graduate education the highest aspirations for research and scholarly integrity. A monograph summarizing the results of this project and the achievements of participating institutions is scheduled for publication in 2014. We look forward to the contributions that the results of this project will make toward addressing each of these needs in U.S. STEM graduate education, and look forward to the broad exchange of ideas these results may inspire with our respective partners abroad.
NOTES

1 This framing paper was developed to stimulate discussion of a draft template designed to assist researchers, faculty, graduate schools, and staff in the development of learning outcomes for research ethics education in graduate international collaborations. The work is part of a project funded by a grant to the Council of Graduate Schools from the National Science Foundation’s EESE program (NSF#1135345). The goal of this project is the identification of effective strategies for integrating research ethics education into international collaborations. The paper’s authors, Daniel Denecke and Julia Kent, are grateful to the members of a project Advisory Committee for their helpful comments on an earlier version of this paper and for significant input into the templates included at the end of this paper as Appendix A; Advisory Committee members included: Samuel Attoh, Rajendra Bordia, Nilssa Bosque-Perez, Diana Carlin, Andrew Comrie, James Dubois, Peter Ewell, Jeffery Gibeling, Elizabeth Heitman, Maxwell King, and Paul Tam. CGS developed a Request for Proposals that was issued on April 30, 2012 (http://www.cgsnet.org/ckfinder/userfiles/files/CGS_EESE_RFP.pdf). Proposals are due August 15, 2012.

2 For an overview of CGS initiatives in the areas of research and scholarly integrity, see http://www.cgsnet.org/scholarly-integrity-and-responsible-conduct-research-rcr.

3 For analyses on PSI survey data and semi-structured discussions with science and engineering students and faculty on multiple campuses, see CGS 2012 (forthcoming).

4 E.g., NSF #0629344, Ethics Instruction for International Graduate Students in Engineering, NSF # 0734887, “International Dimensions of Ethics Education in Science and Engineering,” and EESE #0933509, “Ethical Awareness in International Collaborations: A Contextual Approach.”

5 Thrush et al. have used IOM’s model as the foundation a climate survey instrument, a pilot version of which was adopted by all awardees for CGS’s current PSI project and administered across all science and engineering fields.

6 This section has been adapted from an excerpt from the revised edition of Assessment and Review of Graduate Programs (CGS 2011, pp.30-32).

7 See Stewart 2011 for further elaboration of CGS’s position on graduate learning outcomes.

8 There have been a variety of other approaches to assessing the effectiveness of ethics education. Some have sought to assess institutional climate, under the assumption that this climate influences research behavior and a better understanding of vulnerabilities here will help educators tailor resources appropriately (Martinson, Anderson, DeVries, 2005; Thrush et al., 2007; Mumford et al., 2006). This work relies on perceptions (e.g., of students, faculty, and researchers), and while these data are invaluable, and a better understanding of institutional climate has important implications for the design and improvement of research ethics education, it is not clear that increased or even improved research ethics education will result in perceptions of an improved climate for integrity, as awareness of needs and deficiencies may become more acute through heightened education.

9 See footnote 1.

10 See the summary of a presentation by Dr. Susan Butts, Senior R&D Director (retired) at Dow Chemical Company, pp. 27-28 in NAS, NAE, & IOM, 2011.

11 In the PSI activities assessment survey, less than half of respondents in the physical sciences, engineering and math reported that graduate students in their programs receive information on "collaborative research" through any medium. Collaborative research ranks second-to-last among twelve areas of S&E research ethics areas.

12 29 university leaders and researchers from 10 countries at CGS's 2008 Global Summit on Graduate Education ("Scholarly Integrity and Research Ethics in a Global Context," ) identified COI, COC, and IP issues as key areas where graduate student need more education to function in a global context, along with: awareness of different local and international agreements governing research; skills to act ethically and responsibly when commercializing one's research; and awareness of IRB processes.

13 CGS Focus Group discussion with graduate deans and PI's from NSF IGERTs and PIREs indicated that responsible authorship and plagiarism were issues of particular concern as universities seek to address cultural factors in international collaborations and training (CGS 2010, p.57).

14 2008 Summit participants called for specific action items relating to access, sharing, and exchange of scientific resources in an
international context, recommending that organizations and universities 1) “identify mechanisms that explicitly address ethical issues that may arise from the mobility of scholars (including the priority issues of digital publishing and plagiarism in an international environment)” and 2) “Develop collaborative mechanisms for addressing plagiarism in an international environment” (CGS 2009, p.133). These recommendations also pertain to the issues of responsible authorship and collaboration described above.

15 It is notable that participating institutions tended to appear at different points on a spectrum of “compliance-based” and “values-based” approaches to research integrity education. Typically, education for compliance emphasizes knowledge about and adherence to norms and codes of conduct, whereas a values-based approach encourages students to learn and internalize positive and high standards for integrity. In some countries, where the regulatory frameworks are ill defined or poorly understood, an emphasis on compliance may have greater importance. In other countries, where regulatory frameworks are well understood, integrity issues may be best addressed by a focus on the values conveyed by the research culture. Different emphases may also have implications for the attitude of faculty and researchers toward enhancement of education and training of graduate students, and their ownership of educational responsibilities in this area. Compliance-based approaches and values-based approaches are not mutually incompatible and sometimes used in combination but typically given different stress in different institutional and national contexts (CGS 2009b; CGS PSI Framework Paper, 2008; Mayer and Steneck, 2007, p. 27).

16 See: NSF #0734887 “International Dimensions of Ethics Education in Science and Engineering (University of Massachusetts, Amherst); NSF #0629344, Ethics Instruction for International Graduate Students in Engineering (Texas Tech); and NSF #0933509, “Ethical Awareness in International Collaborations: A Contextual Approach” (Brown University).

17 We took into consideration the learning objectives developed at UMass and Texas Tech in the draft rubric for the current project. See Appendix A, “Sample Learning Outcomes for Research Ethics Education in International Collaborations,” for the revised version of the document.
Sample Learning Outcomes for Research Ethics Education in International STEM Collaborations

Purpose of the Templates
This CGS project supports a range of activities to enhance research ethics education in graduate international collaborations in STEM fields including the development of graduate learning outcomes. The sample outcomes provided below are designed to support and inspire the development of learning outcomes by project participants for research ethics education in STEM graduate international collaborations.

As indicated in the RFP for this project, proposals should include a plan to develop outcomes for graduate student learning that reflect key research ethics issues relevant to international collaboration. These may include general issues that apply to multiple disciplines as well as issues that are unique to specific STEM disciplines. Competitive proposals will provide evidence that the proposers have thoughtfully considered how the project will identify and develop learning outcomes. Proposals should also explain how these outcomes will be used to enhance graduate education in the targeted programs. The sample outcomes below cover a range of general topics and are not intended to limit or prescribe institutional approaches, nor do they address outcomes that will be unique to specific STEM disciplines. Please note that CGS does not require proposals to use or adapt the specific outcomes on these sample templates, although all may use or adapt any that are applicable and relevant to the institution’s proposed projects.

Institutions are encouraged, however, to include in their plans for developing outcomes each of the three broad content areas on these sample outcomes (cultural context, research practices, and ethical frameworks) and to address different aspects of learning (e.g., knowledge, skills, and attitudes). Examples of ways that proposals might plan to use the templates below might include, but are not limited to: circulation for discussion among a faculty team charged with developing draft learning outcomes for use in one or several international collaborations, facilitation of a focus group of graduate students using these templates to identify issues in research education that would inform the development of learning outcomes, or circulation among individual faculty who will bring expertise to the project team through their prior engagement in graduate learning assessment, research ethics education, and/or international research collaborations.

Method of Creating the Templates
These sample outcomes were generated in dialogue with an international, multi-disciplinary Advisory Committee consisting of STEM researchers (drawn from PI’s on NSF-funded international research collaborations), national experts in learning assessment, national experts in international aspects of research ethics, and university leaders from STEM backgrounds with experience overseeing international research collaborations. The committee provided extensive input on content, but also advised on structure, presentation, and use. A draft of these outcomes, compiled by CGS project staff, was then reviewed by the Advisory Committee and comments incorporated to ensure that they are both relevant to a broad range of STEM disciplines and useful as prompts for institutional development of specific outcomes in graduate programs.
### Sample Learning Outcomes for Research Ethics Education in International STEM Collaborations

#### TEMPLATE 1: Cultural Contexts

"By the time they complete their course of study, students should be able to/are expected to..."

<table>
<thead>
<tr>
<th>Cultural Contexts</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Professional Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Describe several prominent theories of culture and cultural difference.</td>
<td>Situate him or herself in the context of various national cultures and communities.</td>
<td>Question common stereotypes about individuals and researchers from participating countries.</td>
</tr>
<tr>
<td></td>
<td>Identify social, economic, and political factors that may affect research practices in different countries.</td>
<td>Consider various factors in assessing what is attributable to cultural differences and what are individual attributes.</td>
<td>Respect cultural differences and areas of cultural sensitivity.</td>
</tr>
<tr>
<td></td>
<td>Compare structures of hierarchy and modes of communication in home and partner countries.</td>
<td>Seek information about differences in rules of professional etiquette and research practice.</td>
<td>Value self-awareness about culturally shaped values and biases.</td>
</tr>
<tr>
<td></td>
<td>Explain how cultural point-of-view may shape the pursuit of knowledge, including theories and methods.</td>
<td>Take into account contextual information when making judgments about what is right or wrong. Identify effective ways to negotiate with international research partners and resolve differences using knowledge of cultural context.</td>
<td>Demonstrate a willingness to seek information and resources when research norms and policies are conflicting or unclear.</td>
</tr>
<tr>
<td></td>
<td>Compare the relationship between students and research supervisors at partner institutions.</td>
<td>Prioritize the importance of research integrity issues in the context of an international collaboration and identify areas where compromise is or is not possible.</td>
<td>Use cultural knowledge to contribute to a collaborative environment of mutual respect, trust, and accountability.</td>
</tr>
<tr>
<td></td>
<td>Compare policies and norms (explicit or implicit) for research conduct among partnering countries.</td>
<td></td>
<td>Demonstrate appreciation for the distinct contributions of all members of a collaborative research team.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Convey tolerance for different levels of language proficiency and respect for the efforts of those conducting research in a non-native language.</td>
</tr>
</tbody>
</table>
## Sample Learning Outcomes for Research Ethics Education in International STEM Collaborations

**TEMPLATE 2: Research Practices**

“**By the time they complete their course of study, students should be able to/are expected to**…”

<table>
<thead>
<tr>
<th>Research Practices</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Professional Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Explain how national/cultural context may affect researchers’ views of</td>
<td>Examine and question his or her cultural biases in assessing the value</td>
<td>Convey awareness of and respect for local knowledge that can be</td>
</tr>
<tr>
<td></td>
<td>intellectual property and data ownership.</td>
<td>of contributions from an international research partner.</td>
<td>contributed by international research partners and/or research</td>
</tr>
<tr>
<td></td>
<td>Define plagiarism and explain how it may be viewed differently in different</td>
<td>Analyze ethical and practical challenges of sharing data and resources</td>
<td>Show sensitivity to differential access to materials or technology</td>
</tr>
<tr>
<td></td>
<td>research cultures.</td>
<td>among international research partners.</td>
<td>e.g. issues of waste, unreliable internet access.</td>
</tr>
<tr>
<td></td>
<td>Identify gaps and differences in national protocols and policies regarding</td>
<td>Facilitate the sharing of data and resources among international</td>
<td>Demonstrate openness to learning about local practices for data</td>
</tr>
<tr>
<td></td>
<td>equal access, transparency, and confidentiality.</td>
<td>research partners when appropriate.</td>
<td>management, access and exchange.</td>
</tr>
<tr>
<td></td>
<td>Explain how cultural, political, and economic contexts may shape views on</td>
<td>Seek effective ways to clarify ownership of knowledge and cultural</td>
<td>Demonstrate willingness to communicate with appropriate local</td>
</tr>
<tr>
<td></td>
<td>information sharing and data access.</td>
<td>and natural resources.</td>
<td>authorities that may control the research process.</td>
</tr>
<tr>
<td></td>
<td>Identify differences in national or cultural norms regarding authorship</td>
<td>Promote team-based publication in English and local languages, and</td>
<td>Convey concern for different cultural approaches to establishing</td>
</tr>
<tr>
<td></td>
<td>order and other formal acknowledgment procedures.</td>
<td>seek to address the causes of plagiarism.</td>
<td>trust among international research partners.</td>
</tr>
<tr>
<td></td>
<td>Describe scenarios when information and data sharing may not be possible</td>
<td>Identify methods to build the research capacity of international</td>
<td>Convey interest in sharing benefits arising from the use of</td>
</tr>
<tr>
<td></td>
<td>due to national security or political concerns.</td>
<td>researchers with available material and human resources.</td>
<td>information and knowledge provided by research subjects in partner</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>countries.</td>
</tr>
</tbody>
</table>
Sample Learning Outcomes for Research Ethics Education in International STEM Collaborations

**TEMPLATE 3: Ethical frameworks**

<table>
<thead>
<tr>
<th>Ethical Frameworks</th>
<th>Knowledge</th>
<th>Skills</th>
<th>Professional Attitudes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Define ethical values and principles and explain how they differ from laws, policies, and codes of conduct.</td>
<td>Identify and prepare for ethical risk in countries where research regulations differ or where none exist.</td>
<td>Demonstrate a willingness to seek information to place ethical issues in proper local and cultural context.</td>
</tr>
<tr>
<td></td>
<td>Explain how culture may shape values and ethical principles.</td>
<td>Seek input from international research partners in defining and measuring the benefits and outcomes of research.</td>
<td>Show respect for all human lives regardless of citizenship and culture in international collaborations involving human subjects.</td>
</tr>
<tr>
<td></td>
<td>Identify common ethical challenges that arise in international research collaboration(s) in one’s field.</td>
<td>Compare and analyze the costs and benefits to international research partners in different collaboration scenarios.</td>
<td>Demonstrate concern for limitations on the ability of research participants in some countries to provide informed consent.</td>
</tr>
<tr>
<td></td>
<td>Provide examples of the way ethical norms and cultural values may lead to conflicts among international research partners.</td>
<td>Take into consideration cultural values, ethical principles, and contextual information when resolving ethical problems that arise in international research.</td>
<td>Acknowledge that the “right” decision in one country may lead to unintended ethical consequences in another.</td>
</tr>
<tr>
<td></td>
<td>Explain how culture may shape views on research with human subjects.</td>
<td>Formulate and analyze alternative ways to solve an ethical problem in international research.</td>
<td>Respect differential impacts and broader societal outcomes of research in the home and partner country.</td>
</tr>
<tr>
<td></td>
<td>Articulate ethical principles for conducting collaborative research with international research partners.</td>
<td>Consider how research outcomes may be presented and interpreted in different national contexts.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Describe collaboration scenarios where ethical decision-making may be complex and based on information that is uncertain or unclear.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
WORKS CITED


Anderson, MS; Kot, FC; Yiyun, J; Kamata, T; Kuzhabekova, A; Lepkowski, CC; Shaw, M; Sorenson, M. and Vasconcelos, SMR. Differences in national approaches to doctoral education: Implications for international research collaborations. In Anderson and Steneck 2011.


Mayer, T. and Steneck, N.H. (2007). Final report to European Science Foundation (ESF) and Office of Research Integrity (ORI) First World Conference on Research Integrity: Fostering Responsible Research, September 16-19 2007 (Lisbon, Portugal).


