Sci Eng Ethics
DOI 10.1007/s11948-016-9775-0

ORIGINAL PAPER

The Need for Social Ethics in Interdisciplinary Environmental Science Graduate Programs: Results from a Nation-Wide Survey in the United States

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Received: 2 January 2016 / Accepted: 16 March 2016

Abstract Professionals in environmental fields engage with complex problems that involve stakeholders with different values, different forms of knowledge, and contentious decisions. There is increasing recognition of the need to train graduate students in interdisciplinary environmental science programs (IESPs) in these issues, which we refer to as "social ethics." A literature review revealed topics and skills that should be included in such training, as well as potential challenges and barriers. From this review, we developed an online survey, which we administered to faculty from 81 United States colleges and universities offering IESPs (480 surveys were completed). Respondents overwhelmingly agreed that IESPs should address values in applying science to policy and management decisions. They also agreed that programs should engage students with issues related to norms of scientific practice. Agreement was slightly less strong that IESPs should train students in skills related to managing value conflicts among different stakeholders. The primary challenges to incorporating social ethics into the curriculum were related to the lack of materials and expertise for delivery, though challenges such as ethics being marginalized in relation to environmental science content were also prominent. Challenges related to students' interest in ethics were considered less problematic. Respondents believed that social ethics are most effectively delivered when incorporated into existing courses, and they preferred case studies or problem-based learning for delivery. Student competence is generally not assessed, and respondents recognized a need for both curricular materials and assessment tools.

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Published online: 30 March 2016

Keywords Interdisciplinary research · Graduate education · Natural resource decision making · Social ethics

Introduction

Effective engagement with complex environmental issues requires professionals who are trained not only in the best available science, but also in the social dimensions of science. Whether working with other researchers or serving as expert consultants, policy-makers, or resource managers, professionals in the environmental field must be able to make considered decisions concerning, for example, how to engage with other stakeholders and how to identify relevant forms of knowledge in evaluating environmental problems and responses. Many of these decisions have ethical significance, insofar as they involve the distribution of goods and harms and variably affect opportunities for different actors to influence their outcomes. Historically, many graduate programs have assumed that the domain of ethics is restricted to the morally appropriate behavior and conduct of individual scientists (often referred to as responsible conduct of research, or RCR). Schienke et al. (2011) label this domain "procedural ethics." However, organizations and professions have begun recognizing that training in ethics must extend beyond the procedural realm (duBois and Dueker 2009); graduate programs need to expand their teaching of ethics to encompass what some scholars (e.g., Herkert 2005) call "social" ethics, i.e., the "collective social responsibility of the profession" (p. 374). Schienke et al. (2011) distinguish "intrinsic ethics" from "extrinsic ethics," contrasting both with "procedural ethics." Intrinsic ethics concern "ethical issues and values that are embedded in or otherwise internal to the production of scientific research and analysis" (p. 506), including what are referred to as "epistemic values" (e.g., Steel and Whyte 2012). Extrinsic ethics concern "ethical issues that… are external to scientific practice" (p. 505), such as the appropriate role of science in policy processes. We use the term "social ethics" to cover both intrinsic and extrinsic ethical considerations.

Current literature discussing graduate education in policy-relevant science is replete with calls for the development of more effective tools to teach social ethics (e.g., Elgin 2011; Sadler and Zeidler 2005; Schienke et al. 2011). However, whether and how graduate programs in science and engineering are responding to these calls remains an open question. In this article we report the results of a survey of faculty and leaders from interdisciplinary environmental science programs (IESPs) across the United States. This survey investigated the needs, approaches, and challenges faced in educating graduate students regarding a range of topics and skills related to social ethics.

We begin with a brief overview of social ethics and the challenges associated with addressing social ethics in IESPs. Our review of the literature demonstrates that the need to include such training has been acknowledged by professional and scientific organizations, but has yet to be fully met, for a variety of reasons. Drawing on this literature, we developed a survey tailored to IESP faculty and program leaders, which we administered online. The results affirm the need to address social

ethics in IESP curricula, identify specific barriers to doing so, and reveal beliefs about the most effective formats for delivering such content. Based on these findings, we recommend specific content areas, delivery formats, and assessment tools.

Social Ethics in Environmental Science

Social ethics are especially important when considering environmental issues, because such issues tend to be what Berry et al. (2013) label "fractious problems"—they are ill-structured (Newstetter 2006), with many valid perspectives and alternative solutions (Jonassen and Cho 2011; Ramaley 2014). Problems like climate change, invasive species, and water pollution are entangled with issues of social justice and governance, insofar as different alternative solutions privilege the interests of different stakeholders. For example, climate change could potentially be addressed through a tax on gasoline or by a subsidy for inner city residents to install solar panels. Clearly these actions would differ not only in effectiveness, but also in which social groups bear the costs and gain the benefits. Choosing among alternative responses therefore entails deciding to value one set of interests over others, and this decision concerning interests and well-being falls within the province of ethics (Norton 2005; Thompson and Whyte 2011). To be effective in their later professions, students must learn how and when to differentiate questions that are predominantly about values from questions that are predominantly about facts, and they must be able to articulate the difference to others.

Complicating matters, the factual scientific information bearing on fractious problems is often incomplete and uncertain (Keefer et al. 2012; Schrag 2008). Scientists must be able to present their assumptions and the precision and uncertainty of their findings in ways that help stakeholders and decision makers understand the utility and limitations of science for problem solving. Regrettably, students often master the mechanics and tools of scientific study without appreciating the difficulties of moving from, for example, the findings of an experiment to a recommendation about how to address an actual environmental problem (Whyte et al. 2015). Students in IESPs "need to learn to cope with gray areas, where values conflict, where justifications for one choice or another are not obvious, [yet] where difficult decisions nonetheless must be made" (Eisen and Berry 2002, p. 42).

Beyond needing conceptual and analytic tools to understand social ethics issues surrounding the use of science to inform policy and practice, scientists must recognize how the epistemological assumptions manifested in the practice of science and the ontological assumptions implicit in science-based policy recommendations are themselves expressions of values intrinsic to science (Schienke et al. 2011). As Jones et al. (1999) noted, values are embedded in all knowledge claims, though this fact often goes unnoticed by scientists. When scientists do not recognize how the norms of their scientific practice tacitly encode certain assumptions and values, they may dismiss other potentially fruitful contributions to addressing environmental problems that do not conform to those norms. This can result in the marginalization of diverse and legitimate forms of knowing, such as traditional

ecological knowledge. Students in IESPs must develop sufficient reflexivity to recognize their own ethical and epistemic and ontological commitments, as well as sensitivity to understand other ways of analyzing and knowing about fractious problems. That is, students need to develop an understanding of how practices and institutions (including science itself) are manifestations of values (Jones et al. 1999).

Ethical concerns related to values can come to the fore when scientists engage directly with policy and management. In practice, addressing fractious problems requires engagement with stakeholders and attention to the social context of decisions (Børsen et al. 2013; Ramaley 2014). As scientists—who may feel removed from their subject matter due to their epistemological assumptions—are increasingly consulted for their expertise on social problems, they must inevitably grapple with questions concerning which stakeholders should be included in the process, when to include them, and how they should be involved. Students need to consider the different roles they, as scientists, might play in shaping management decisions (Eisen and Berry 2002).

Thus, the umbrella of social ethics covers several topics that could be incorporated in graduate training in IESPs. However, making students aware of these topics is only the first step. If they are to become effective scientists and members of society, students must also develop skills to manage the ethical issues surrounding the fractious problems they will encounter in their professional careers. These skills include the ability to reflect critically on how their own values shape their professional and scientific practice. They also include interpersonal skills to engage other scientists and stakeholders who have different approaches to diagnosing, understanding, and responding to problems, such as the ability to facilitate discussions that constructively air value differences, techniques for conflict resolution when tensions arise, and tools to reach consensus in diverse groups (Hall and O'Rourke 2014).

Existing Challenges to Incorporating Social Ethics in Graduate Education

Attention to ethics in graduate education has slowly but continually expanded over recent decades. Many professional organizations, including the National Science Foundation, the National Institutes of Health, and the Accreditation Board of Engineering and Technology (ABET), require ethics training for graduate students (Berry et al. 2013; duBois and Dueker 2009; Kon et al. 2011). These requirements go beyond RCR training to include elements of social ethics. As one example, the American Association of Engineering Societies calls for appreciation of cultural differences and promotion of an ethic of sustainability (Herkert 2005). Similarly, ABET requires education in ethical aspects of engineering related to economic, environmental, social, and political constraints (Herkert 2005; Jonassen and Cho 2011).

Given these admonitions from prominent institutions, we might expect social ethics to be covered in graduate IESP training. Most of the material and tools currently available still relate primarily to RCR (Anderson et al. 2012) or other aspects of professional conduct (Li and Fu 2012; Schrag 2008). Students learn about appropriate treatment of human subjects, animal care, plagiarism, falsification of

data, and other procedural ethics issues. However, most of the social ethics issues described above are covered haphazardly, at best (Børsen et al. 2013; Boyle 2004). Overall, educational tools for helping graduate students think about how to engage in socially responsible decision making appear to be lacking. Regrettably, students in IESPs can emerge from their programs believing that if they act responsibly and with personal integrity, they have adequately addressed all relevant ethical considerations. As we have seen, though, tackling fractious problems requires a sensitivity to a range of complex and non-obvious social considerations.

Why have we largely failed to meet the call for social ethics education in graduate programs in science and engineering? Several factors have been identified in the literature. The first is simply a lack of awareness of the issues among academic faculty and program leaders (McCormick et al. 2012). Faculty in some programs continue to see the practice of science as a value-neutral endeavor, separated from the realm of stakeholders and decision making. That is, they do not believe that values shape their science, or that scientists' decisions to engage (or not) in policy making processes are themselves a result of value priorities.

A second barrier to incorporating social ethics in graduate training is the lack of time to address ethical issues in programs where technical requirements are increasing (Eisen and Berry 2002; Schrag 2008). This issue is further compounded by pressure to shorten times to graduate in higher education, making faculty reluctant to require additional coursework. As scientific fields become increasingly specialized, less time is available to devote to issues perceived to have lower priority, and ethics tends to fall into this category of expendable content. This outcome may be due to ethics being considered simply as procedural and/or extrinsic to the practice of science.

But even in programs where faculty recognize the need for ethics training and would like to include ethics material, resources and expertise are often lacking. It is rare for faculty to have received social ethics training during their own graduate education. They may believe that they are unqualified to teach such topics in any formal way (Eisen and Berry 2002; Newstetter 2006; Wolpe 2006). IESPs rarely include ethicists as members of their core faculty, and courses available from other departments (e.g., philosophy courses) may not meet the specific needs of IESP students.

Study Purpose

Our literature review suggested that there is interest in including social ethics in IESP curricula that is not fully realized. It also highlighted potential instructional challenges. Therefore we sought to answer the following research questions.

> RQ1: How do faculty in IESPs rate the need to include different dimensions of social ethics topics and skills in their curricula?

IESPs span a broad range of disciplines, from engineering to humanities. Different disciplines will have different constraints posed by professional codes and

organizations, which may affect how they address ethics, including social ethics, in their curricula. IESPs also address a suite of environmental problems, from water quality or climate change, to food and nutrition. Some are explicitly oriented toward environmental justice, while others emphasize technical science. As such, they may differ in their assumptions about the role of science in society and the need to train students in social ethics content and skills. Therefore, our second research question was:

> RQ2: Do participants' views about the need for social ethics in IESPs differ based on the topical focus of the IESP?

Beyond evaluating the level of interest in ethics, we also wanted to identify the type and extent of ethics material currently offered in IESPs. Additionally, we sought to understand the primary barriers to inclusion of this material. This generated two research questions:

> RQ3: How do IESPs presently deliver material and assess student performance related to social ethics?
> RQ4: What are the primary challenges or barriers to delivering social ethics material in IESPs?

Finally, we wanted to understand the perceived effectiveness of different teaching practices for social ethics. Therefore, our final research question was:

> RQ5: What pedagogical practices do faculty in IESPs consider to be most effective for engaging students in social ethics?

Methods

Sample Selection and Recruitment

To identify IESPs in the United States, we referred to two lists maintained by professional academic organizations. First, we used the program affiliate roster of the Council of Environmental Deans and Directors (http://www.ncseonline.org/programs/education-careers/university-affiliates/current-affiliates). Membership includes both degree-granting IESPs and institutional directives; we only invited faculty members associated with degree-granting programs. Second, we used a list of degree-granting interdisciplinary programs compiled by Dr. Rick Szostak for the Association for Interdisciplinary Studies (http://wwwp.oakland.edu/ais/resources/directory/) to identify programs with an environmental focus.

All individuals listed as program leads or affiliated faculty in these IESPs were included in the sample. We collected email addresses from centralized lists or gathered contact information from websites for each university or department. This process generated a list of 3378 unique individuals associated with IESPs across the country.

Study participants were sent an initial email soliciting their participation in the study. (They were assured of confidentiality and provided information as required

through the University of Idaho's Institutional Review Board.) Of the 3378 unique email addresses, we received 45 auto-returns from incorrect or expired accounts. Thus, the total number of valid invitations was 3333. The email message directed participants to a website where the survey was hosted through Qualtrics. After 10 days, individuals who had not yet participated were sent a follow-up email requesting their participation.

Survey Instrument

The introduction to the survey defined the scope of our study as graduate IESPs across the United States. In the landing page, the goal of the survey was described as understanding the ethics needs of IESPs. In the survey itself, "ethics materials" were defined as "educational content that helps facilitate the systematic study and evaluation of actions as good or bad, right or wrong, just or unjust."

To characterize participants, we asked them to report the number of years they had been engaged in interdisciplinary education and their role(s) within their IESP. We also asked them to state which discipline best described their own expertise, which we classified into 10 groups. The classification was informed by categories developed by the National Council for Science and the Environment (Vincent et al. 2013). Rather than using these categories verbatim, we synthesized them into categories that best represented the survey respondents' disciplines. To understand the scope of each IESP, we asked participants to identify the topical areas of focus within their program, using 14 categories. Regarding coverage of ethics within their programs, we asked participants how well they felt ethics material is delivered and how well they felt student competence in social ethics areas is assessed.

Many of the specific ethics content items in our questionnaire were informed by existing research on ethics education, particularly in interdisciplinary graduate programs. One set of items included topics related to the role of values in environmental science and problem solving (Brown 2013; Douglas 2009; Kincaid et al. 2007) and how to address aspects of research that have ethical implications, such as expertise (Collins and Evans 2002; Nelson and Vucetich 2009). Related to skills, one set of items asked about the importance of developing skills to become more reflexive (Jordan et al. 2008), while another set asked about skills to manage disagreements and conflicts among stakeholders or scientists (Fortuin and Bush 2010). These content and skill items were presented with a 5-point Likert-type response scale (1 = not at all important; 2 = marginally important; 3 = moderately important; 4 = very important; and 5 = extremely important).

The survey then presented 13 potential challenges or barriers to addressing social ethics, using a 7-point Likert-type scale (1 = strongly disagree; 4 = neither agree nor disagree; 7 = strongly agree). These were organized into three categories: (1) individual qualities of students themselves, such as lack of interest (Bernstein et al. 2010; Sims and Felton 2005), maturity (Abdelkhalek et al. 2010), or comfort with ambiguity (Lilley and Lofthouse 2010); (2) institutional barriers, such as lack of incentives (Bernstein et al. 2010) and instructor capability (Sims and Felton 2005); and (3) pedagogical challenges, such as the availability of instructional materials.

A final section of the survey investigated participants' views on how best to deliver ethics material. These items were drawn from educational literature and covered the full suite of approaches from traditional models (e.g., lecture or guided discussion) to creative learning activities (e.g., story-telling, debates, or role play). Questions also asked about preferred approach to ethics instruction, including integrating ethics into existing courses or offering ethics material as stand-alone modules.

Analysis

To permit comparison across different types of IESPs (RQ2), we needed to condense the multiple items into indices, which we accomplished through factor analysis, using Cronbach's alpha to confirm internal consistency of the items. Alpha values $\geq$0.80 were considered adequate (Kline 1993). Several survey questions had space for respondents to write narrative responses or explanations, and a final question solicited general comments. These questions generated more than 100 pages of text, which we explored through a content analytic process where we looked for ideas we had identified from the literature, as well as new ideas that emerged in the data. Two members of the research team read through all the comments independently and then met to discuss the main themes we had identified.

In discussing results, we present both quantitative data and excerpts from the open-ended responses and comments. Text excerpts were chosen to illustrate the most common points as well as points that we had not identified in the literature. For frequently mentioned points, we chose excerpts that best captured the sentiments expressed across respondents, whereas for the new points, we chose excerpts that provided the most insight. Excerpts are identified with the respondent's unique identification number and his/her scholarly discipline.

Results

Study Participants and Characteristics of Their Interdisciplinary Environmental Science Programs

We received 480 surveys from individuals at 81 different colleges and universities across the United States. The largest number of respondents from a single program was 23, with a median of five respondents per program. Respondents held multiple roles: most (65.5 %) served as a major professor for graduate students or as an instructor of courses (56.1 %). Approximately equal numbers held a director role (13.3 %) or were members of a program steering committee (14.2 %).

Respondents were asked to describe their expertise, and we classified these into 10 categories, with each respondent assigned to the one category that best encompassed his/her discipline (Table 1). Study participants represented a wide range of disciplines, as might be expected. Environmental, life, and earth scientists dominated the sample, while a few disciplines (such as economics and the humanities) were poorly represented.

Table 1 Respondents' self-reported areas of disciplinary expertise

	Percent
Environmental sciences	23.1
Social sciences	13.7
Life sciences	12.5
Earth sciences	11.7
Natural resources planning, policy and law	7.7
Engineering	6.3
Physical sciences	4.4
Humanities	3.7
Economics	3.3
Other	2.1
None given	11.5

Most respondents had many years of experience in interdisciplinary research or teaching: just over one-third (36.7 %) had more than 20 years of experience, while another third (33.8 %) had between 11 and 20 years of experience. Only 7.4 % had fewer than 5 years of experience. Due to the large proportion of participants with extensive experience, the sample could speak authoritatively about their IESPs.

Table 2 Respondents' ratings of the importance of social ethics topics

	Mean[a]	SD	% V − E[b]
Topic factor 1: Awareness of values issues (n = 450); alpha = 0.8			
The trade-offs among competing public values when making management and policy decisions	4.1	0.8	81.7
The different roles citizens may take in shaping management and policy	3.9	0.9	69.2
The different roles scientists may take in shaping management and policy	4.0	0.8	78.2
The different forms of expertise that are relevant for decision making and policy (e.g., recognition that expertise is to dependent solely on formal education, but may take the form of local or traditional ecological knowledge)	3.8	0.9	67.4
Awareness of the range of perspectives that exist on the concept of harm to human-environmental systems	4.1	0.8	78.0
The intrinsic value of non-human entities when making management and policy decisions	3.7	1.0	62.5
Topic factor 2: Norms of scientific practice (n = 452); alpha = 0.7			
Ways to consider and discuss uncertainty in scientific conclusions when communicating science to managers or stakeholders	4.2	0.8	82.8
Awareness of the laws and regulations that influence the conduct of science	3.9	0.9	69.5
Awareness of the unofficial (cultural/moral) practices that influence the practice of science	3.9	0.8	71.1

[a] Scale: 1 = Not at all, 2 = marginally, 3 = moderately, 4 = very, 5 = extremely

[b] % V − E = percent marking 4 or 5 on the scale (very or extremely important)

Respondents identified the topic areas of their IESP from a list of 17 options supplied in the survey (plus an "other" category). They could select as many as applied and, not surprisingly, most did so; the median number of categories marked was seven. The most common focal areas were environmental science (75.8 %), sustainability (62.1 %), and water resources (61.0 %), while the least common were humanities (15.8 %) and engineering (16.5 %).

Respondents were asked how important stakeholder engagement is in their IESP. Approximately 24 % indicated that this is a "major priority" for their degree program, while 40 % said engagement is "one of several priorities," and 25 % indicated that engagement is "encouraged to some extent." Only 2 % said engagement is not a priority at all, and 9 % indicated that they did not know the answer to this question.

Importance of Social Ethics Content and Skills (RQ1 and 2)

On average, respondents rated most of the topic areas listed in the survey as important to cover in IESPs (Table 2). These quantitative findings were strongly reinforced by responses to open-ended questions. As one respondent wrote, "ethics is integral to decision-making and thus any environmental science program" (126; Anthropology). Likewise, another observed that "potentially any course in the program would benefit from some integration of ethics courses" (285; Philosophy/Ethics).

Of the nine topic areas listed in the survey, those with the largest mean scores were *understanding trade-offs among public values in management and policy*

Table 3 Respondents' ratings of the importance of social ethics skills

	Mean[a]	SD	% V − E[b]
Skill factor 1: Analytic abilities (n = 453); alpha = 0.8			
The ability to identify how different scientific methods are informed by different values	3.9	1.0	70.6
The ability to critically examine how one's own values inform one's research on human-environmental issues	4.2	0.8	81.0
The ability to identify how disagreements among stakeholders are shaped by different values	4.1	0.8	80.1
The ability to identify how disagreements among researchers and the public are shaped by different values	4.0	0.8	75.4
Skill factor 2: Conflict management (n = 457); alpha = 0.9			
The skills to manage disagreements among researchers who have conflicting values	3.8	1.0	63.5
The skills to manage disagreements among stakeholders who have conflicting values	3.9	0.9	67.0
The skills to manage disagreements among researchers and the public who have conflicting values	3.9	0.9	70.5

[a] Scale: 1 = Not at all, 2 = marginally, 3 = moderately, 4 = very, 5 = extremely

[b] % V − E = percent marking 4 or 5 on the scale (very or extremely important)

decisions and *ways to address uncertainty in communicating science*. Factor analysis revealed two factors within these nine topic areas, one related to norms of scientific practice (three items), and one including the other six items, all of which relate to value trade-offs and awareness of the perspectives and roles of different stakeholders. As one respondent wrote, "students need to understand that there is no 'right' answer, that all management decisions are a balance between competing views and values" (340; Geology). Another observed that students need to realize that "'the public' is not monolithic, just as 'scientists' are not a monolithic body (and that 'scientists' are at times members of the public too—that we all play multiple roles)" (315; Forestry/Environmental Studies).

Similar to the high ratings given for topic areas, respondents rated the seven skills listed in the questionnaire as important (Table 3). These items factored into two groups: four items related to one's individual ability to identify the role of values, and three items related to conflict management skills. The first group, analytic abilities, was seen as more important than interpersonal conflict management skills. Open-ended comments clarified the reason for this difference; specifically, some programs train students for careers where they will not directly engage with stakeholders, so conflict management skills were rated as less important. Even so, the three items about conflict management were rated as very or extremely important by more than 60 % of respondents. Respondents wrote about the importance for students to be able to "mediate interactions among stakeholders with different perspectives" (8; Molecular Biology), develop the "ability to listen to

Table 4 Mean importance ratings for social ethics topics and skills, by IESP focal areas

	Topic factors		Skills factors	
	Understanding value differences	Norms of science	Analytic abilities	Conflict management skills
Humanities	4.3	4.3	4.4	4.1
Social science	4.1	4.1	4.2	3.9
Global environmental issues	4.1	4.1	4.2	4.0
Environmental science	4.0	4.0	4.0	3.9
Natural resources	4.0	4.1	4.1	3.9
Energy	4.0	4.1	4.0	3.9
Fish and wildlife	4.0	4.1	4.0	3.9
Terrestrial ecology	4.0	4.1	4.1	3.9
Sustainability	4.0	4.0	4.1	3.9
Engineering	3.9	4.1	4.0	3.9
Climate science	3.9	4.1	4.0	3.9
Marine	3.9	4.1	4.0	3.9
Water	3.9	4.0	4.0	3.8
Earth sciences	3.0	4.0	4.0	3.8

[a] Scale: 1 = Not at all, 2 = marginally, 3 = moderately, 4 = very, 5 = extremely

others effectively" (240; Ecology), and cultivate "compassion, humility, tenacity, and a sense of humor" (135; Ecology).

An open-ended question asked respondents to identify any other content or skill areas they deemed important, and 98 people supplied responses. Several noted the importance of insuring that students appreciate cultural variation in environmental ethics and perspectives, the development of "respect for other viewpoints" (212; Sustainability), and working to create "possibilities for the inclusion of alternative approaches" (174; Sociology). Many respondents also highlighted social and environmental justice as critical topics, including linkages between environmental problems and poverty, human health, and food security. One respondent elaborated on the "disparities in exposure to environmental harm and lack of access to environmental goods" (58; Geography), while another summed up by writing that students need to understand "issues of inequality" (463; Geography).

The mean importance values for each of the four topic and skills factors did not differ dramatically with program focus (Table 4). For the topic factor related to understanding value differences, means for the fourteen program types ranged from 3.9 to 4.3. For the topic factor related to norms of science, means ranged from 4.0 to 4.3. Similarly, for the skills factor related to analytic abilities, means ranged from 4.0 to 4.4. For the skills factor related to conflict management skills, means were slightly lower, ranging from 3.8 to 4.1.

Open-ended comments on the survey revealed some considerations about the scope and nature of ethics that we had not anticipated. One of these was variation among respondents in how they construed the domain of ethics. Some people, albeit only a few, seemed to have notions of ethics that were very narrowly circumscribed. This led them to assert that ethics is not pertinent in their IESPs. For instance, one oceanographer wrote, "I have no idea why an ethics course or material would be relevant to our curriculum" (300). Likewise, a marine ecologist felt that "ethical problems are not an overwhelmingly obvious matter of concern in the marine area" (370). An environmental engineer even commented that "sustainability is complex enough without adding ethics to the mix" (159).

Several respondents, particularly from the biophysical sciences or engineering, appear to have assumed the term "ethics" referred only to professional conduct, and not social ethics. For example, one explained that his program offers "a responsible conduct of research class; therefore ethics is not a learning objective for each individual course" (314; Bioengineering). Similarly, another felt that "ethics is mostly important for IRB [institutional review board] clearance. I doubt students or faculty want to know any more than is necessary for merely satisfying bureaucratic requirements" (433; Anthropology).

The open-ended responses revealed another interesting tension between respondents who think science is and should be value neutral, those who think their science does and should support particular positions on social issues, and those who think graduate training should facilitate consideration of a diversity of values without endorsing any particular position. Some of the respondents who saw less value in ethics education subscribed to a strict division between science and application (decision making or environmental management), which meant that "ethics isn't a main priority" in training their students (72; Environmental Science). To these

people, "ethics" seemed to mean public advocacy of particular policy positions, which they viewed as outside the purview of science. Indeed, one person criticized ethics material because it "is not unbiased," which "promotes advocacy based on fashion/politics and not science" (74; Social Science). Another person concurred, arguing that "scientific neutrality" must be upheld in the ecological sciences (116; Forest Ecology).

On the other hand, some respondents felt strongly that a specific ethical stance should be cultivated and expected in their students and that these stances are not incompatible with the scientist's role.

> "If these students are going to become the next leaders in conservation they need to be able to make the right ethical decisions. I think one of the most important is making decisions for the benefit of the species, ecosystem and local communities that live there, and not decisions that are just a way to force their personal agenda or view point" (195; Wildlife Science).

Another respondent wrote,

> "My view (also as a trained ecologist)… is that we are losing the living resources of the planet at such a pace that that we must now do more than 'count the deck chairs on the Titanic.' My view is that what currently passes for politics and economics is unethical. The ethics crisis is not … [because of] environmental scientists, it is … [caused by] people who will not listen to environmental scientists" (363; Oceanography).

Still other respondents reflected on the problems created for students by programs that promote a particular ideology. One respondent from a forestry program was troubled by her program's "lack of diversity regarding point of view" (353; Forestry). Students in the program are "taught one way ('the right way') of doing things, with little room for divergent opinions. This environment is not conducive to nuanced discussion of ethics." Another faculty member with a background in environmental science and policy stated that "there is a presumption about the ethical stance our students should take rather than a structured exploration of how to form an ethical perspective and an opportunity to form one with respect to the materials provided" (355).

Delivery and Assessment of Social Ethics in IESPs (RQ3)

When asked how well ethics is covered in their IESP, 20.1 % of respondents marked the "don't know" option. Most of these people were instructors and/or major professors in the IESP; individuals in director (100 %) or steering (89.6 %) roles were more likely to have an opinion about how well the program delivers ethics instruction. The written comments indicate that many instructors are simply not aware of what is being taught by other faculty in their IESP.

Among respondents who reported having knowledge of how ethics is taught, a slight majority said that ethics material is somewhat (41.4 %) or very well (11.7 %) covered in the existing curriculum (this equates to 42.4 % of all respondents, including those who marked "don't know"). Open-ended comments revealed that a

handful of programs have deliberately incorporated social ethics material throughout their curricula. In these programs, "ethical consideration is extremely important" to the faculty, so they all "cover ethical material in… other graduate courses" besides dedicated ethics classes (182; Conservation Ecology). More commonly, however, respondents who felt that ethics is sufficiently covered pointed to individual courses that filled their needs, rather than program-wide integration. As one person wrote, "we devote an entire course to ethical issues ranging from ethical issues in research, to environmental philosophy and thought, to worldviews and decision making" (221; Juris Doctorate). Similarly, another respondent said that ethics "is effectively covered because students have theoretical and practical courses on environmental policy, environmental ethics, and biocultural conservation" (274; Environmental Science/Philosophy).

Among respondents with knowledge of delivery, nearly half evaluated current delivery as ineffective (26.5 %) or neither effective nor ineffective (20.4 %). Associated open-ended comments were likely to point out either that "there is currently no discussion on ethics related to environmental issues" (435; Environmental Science and Engineering), or that there is "no organized strategy for including ethics in coursework as part of the program" (209; Geography). Respondents from many IESPs reported that ethics is covered to the extent that individual faculty members have interest, expertise, and motivation. For instance, one program has "an ethical vision and mission statement, but it is largely left up to individual professors about whether there will be any explicit attention to the ethical dimensions of our work" (57; Environmental Studies). In another program, "there are no guidelines to which courses will cover the material, so all efforts are left up to individual instructors" (153; Environmental Science). One faculty member captured the sentiments of many respondents, saying, "we do not have good course materials for ethics. I have tried to put together a course module on ethics, but it is not clear WHAT the students should learn about ethics nor HOW we should teach this material. I would really like to see some online course materials available that would help us with this" (105; Geophysics).

Perhaps unsurprisingly, respondents from programs with a focus in the humanities or social sciences were the most likely to rate their inclusion of ethics material as somewhat to very effective (60–70 %; Fig. 1). On the other hand, programs with a focus on marine resources, engineering, and water resources were the least likely to do so (45–55 %).

Across all respondents, 26.9 % did not know if their program assesses student learning of ethics content. Slightly more than one quarter of instructors and major professors did not know about assessment, but even among directors (17.7 %) and steering committee members (26.9 %), the lack of awareness about assessment was notable. The majority of those with knowledge about assessment said that ethics competency is not assessed. Even among directors—who would presumably have the best knowledge—54.9 % said no assessment is done. (This percentage was nearly 70 % among instructors and major professors with knowledge of assessment.)

The survey did not list specific types of assessment activities; instead it asked respondents to describe how assessment is performed, which generated a variety of

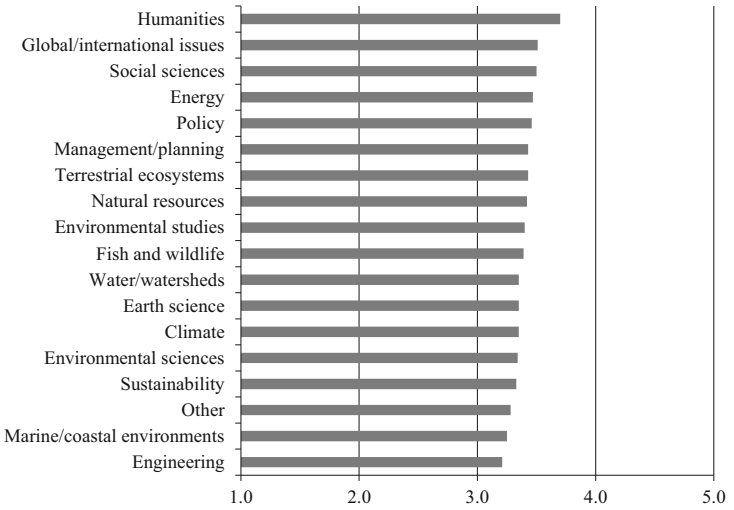

Fig. 1 Mean assessment of how well ethics material is covered, by program focus. Response to question: Overall, how effectively do you think ethics material is currently being covered in your program? (1 = very ineffectively; 3 = neither; 5 = very effectively; don't know responses excluded)

activities and assignments. Commonly, these were written work, such as "essays that the students write" or, "in some situations (as with visits to community stakeholders)… careful reflective journaling to help students take time to reflect on the ethical implications of those discussions" (206; Ecology and Evolution). Other common assessment tools were exams or evaluation of class discussions.

The way respondents described these activities suggested that assessment is generally not guided by structured rubrics. For instance, one person wrote that "mostly we ask them during their preliminary examination to explore the ethical or normative dimensions of their area of study" (464; Philosophy), suggesting that the content of this discussion is not formally structured. Another respondent wrote, "I check the viability of their arguments in written assignments, checking for integrity, authenticity, good references, and clear coherent details" (265; Civil and Environmental Engineering). Some respondents stated that their assessments are largely impressionistic, as exemplified here:

> "I try not to assess students in terms of whether they agree with me or not, but whether they are reflecting on what is ethical in applying the themes of our courses, how well they can articulate and advocate for their position, and if I see a flexibility where they can refine their ethical commitments in light of new information. I don't have a systematic way of doing this, however" (57; Environmental Studies).

One respondent who relies on "discussion and papers to help students understand the inclusion of personal, social and agency values in environmental assessment" summed up the overall state of assessment, writing, "my assessment of their ethical training is very subjective" (429; Environmental Science).

Challenges and Barriers to Delivery of Ethics Content (RQ4)

Two-thirds of respondents disagreed that students lack interest or maturity to engage with social ethics material. However, nearly half agreed that students expect absolute answers and are uncomfortable with ambiguity (Table 5). One faculty member observed that "students are reluctant to engage in material and especially to take a position on issues that involve difficult or complicated tradeoffs between multiple outcomes. I think many students become disappointed/depressed that there are very few win–win solutions available" (377; Social Psychology).

Students were also described by some respondents as being uncomfortable when asked to critically examine and explain their own points of view: "Students do not engage in the discussion readily. They have their opinions and do not seem to want to discuss why or how they arrived at those opinions" (224; Molecular Biology). One respondent observed that this can occur because "people confuse ethics, an internally consistent decision framework, with their own preferences and what they

Table 5 Challenges to incorporating social ethics in IESP curricula

	Mean[a]	SD	Percent	
			Agree	Disagree
Student challenges (n = 453); alpha = 0.7				
Students lack maturity and life experiences to understand how ethics applies to their work	3.1	1.6	26.6	61.6
Students lack interest in ethics materials	3.1	1.6	23.7	60.8
Students with different cultural backgrounds may be uncomfortable discussing ethics materials	3.5	1.6	29.7	50.1
Students expect absolute answers and struggle with ambiguity	4.0	1.7	48.4	40.4
If ethics-focused courses are offered, student enrollment is low	3.7	1.3	21.1	30.1
Institutional challenges (n = 458); alpha = 0.8				
Limited course time is available for ethics because of the need to cover other topics	4.7	1.7	64.3	22.8
Ethics is a low priority for faculty in this program	3.6	1.5	29.4	47.5
Ethics is a low priority among the leadership of this program and/or college administrators	3.3	1.5	21.1	53.8
University incentive systems are not conducive to ethics education	4.1	1.6	40.3	31.0
It is difficult to find instructors who can competently cover the specific ethics needs of the program	4.2	1.6	46.4	31.7
Pedagogical challenges (n = 452); alpha = 0.8				
There is a lack of accepted evaluation tools to assess ethics performance in interdisciplinary environmental sciences courses	4.5	1.3	46.1	14.8
Instructors lack creative, engaging, educational materials or activities to teach ethics content	4.3	1.5	47.1	28.3
Instructors want to cover ethics but do not feel they have the background to discuss ethics related content	4.3	1.4	48.5	26.2

[a] Scale: 1 = strongly disagree; 2 = moderately disagree; 3 = slightly disagree; 4 = neither agree nor disagree; 5 = slightly agree; 6 = moderately agree; 7 = strongly agree

view as ethical" (96; no discipline given). Another observed that "students view environmental ethics as a chance to say what they think about values, which is generally a pretty loose and unhelpful conversation" (459; History of Science). There was concern that an unwillingness to think critically about their own stances can impair students' appreciation or empathy for other points of view: "It's sometimes difficult to get students to understand that there is more than one idea about acting responsibly with regard to environmental decision-making" (284; Geography). As noted by another respondent, "it seems difficult for many of our students to understand how someone in a very different place politically, for instance, can still be operating out of an ethical framework as strong as theirs" (206; Ecology and Evolution).

The primary institutional challenge identified by respondents was the lack of time in the program to accommodate ethics material. Although the quantitative survey results suggest that faculty and administrators value ethics, the open-ended questions revealed widespread acknowledgement that ethics material is considered expendable, relative to core content and skills. As universities push to "reduce time to degree and enhance practical job skills to enhance national rankings, layering on ethics training defeats both purposes" (140; Anthropology). Others noted that funding agencies and external partners "want results, not discussion on ethics" (116; Forest Ecology). Ethics "is not something that potential employers prioritize," so IESPs focus "on helping our students prepare for and get jobs" (340; Geology). Some respondents believed that students fail to prioritize ethics highly: "There are so many courses students want to take. Methods and theory are more important than ethics" (433; Anthropology). Another respondent echoed this sentiment, saying that "students often focus on the requirements needed to earn a high grade, or by the perceived need to demonstrate skills required by a potential employer. Ethics takes second stage to these concerns in most cases" (286; MFA). The end result is that programs "continue to turn out students with knowledge but little perspective" (285; Philosophy).

Lack of commitment among faculty and leadership was not deemed a major barrier, but nearly half of respondents agreed that it is difficult to find capable instructors. "These topics are so far outside of most faculty's comfort zones that faculty seem hesitant to include ethics in their own classes" (425; Environmental Policy). One respondent observed, "I don't think that faculty really understand what 'ethics' as a discipline is or where to find materials" (468; Ecology and Evolutionary Biology). Those who do make an attempt are hindered by their own lack of formal training, so what they teach "is largely anecdotal and stems from their own experiences" (469; Engineering). Several respondents felt that it is inappropriate to expect faculty to teach material in which they have no formal expertise. "Would a philosopher be qualified to teach epidemiology; would a mathematician be the right person to develop in students an appreciation and feeling for rhetoric?" (26; Environmental Geography).

The lack of in-house expertise is frequently addressed by having students take classes offered by philosophy departments. However, this creates its own problems because the material is often not obviously linked to the IESP students' interests and careers.

> "If taught by someone not familiar with ethics, courses are often not really ethically rich, or sometimes not even about ethics at all. If taught by an ethicist they are often not taught in a way that is obviously relevant to the students in a given program … We also fail to show students, and our colleagues, how that work might be tied to their research in an empirical and helpful way" (19; Philosophy).

The lack of application frustrates students. As one respondent noted, "I don't think students expect 'absolute' answers, but if the end result of the presentation is to 'think about it,' that isn't very satisfying for applied-oriented people who are trying to put environmental science and policy into action" (76; Fisheries and Wildlife). The upshot is that either non-specialists teach material poorly, or specialists teach it in an abstract, esoteric way. This dilemma leaves IESPs to "muddle along" (22; Environmental Policy).

Institutional norms and structures related to reward and tenure further undermine any connection with ethics education among programs across the university. "If the course isn't within 'their' department, University department chairs are reluctant to have faculty teach such courses" (76; Fisheries and Wildlife). The tenure system is viewed as rewarding "specialization in a field for energetic young scientists who have the greatest capabilities to spread beyond their traditional discipline" (161; Biology). Rewards do not go to faculty who serve the needs of other programs.

Perceptions of Effective Pedagogical Practices

Respondents were slightly more disposed toward covering ethics in a required class than in an elective course (Table 6). Workshop formats—whether single-day or multi-day—met with a lukewarm response, but respondents were substantially more positive about weaving ethics content into required courses. As one person noted, "I would rather see it as part of my course than a stand-alone course; ethics should be part of scientific toolbox, next to stats or philosophy of science" (123; Geography). These respondents viewed ethics as cross-cutting and integral, not a separate topic. One respondent likened it to how programs treat basic skills: "It should be included everywhere and be more fundamental, like writing. Not every class teaches writing,

Table 6 Respondents' evaluation of the effectiveness of approaches to delivering social ethics

Approach	Mean[a]	SD	% V − E[b]
Stand-alone ethics course(s) as an elective	2.7	1.0	19.5
Stand-alone ethics course(s) as a requirement	3.2	1.2	44.0
Single-day workshops (i.e. trainings facilitated by ethics professionals) separate from existing courses	2.9	1.0	29.3
Multi-day workshops (i.e. trainings facilitated by ethics professionals) separate from existing courses	2.7	1.0	22.9
Integration of ethics material into the curriculum of existing courses	3.9	1.0	69.9

[a] Scale: 1 = Not at all, 2 = marginally, 3 = moderately, 4 = very, 5 = extremely

[b] % V − E = percent marking 4 or 5 on the scale (very or extremely effective)

but many require it, and it's expected everywhere. Ethics needs that kind of priority too! Integrating ethics material into all the courses is critical" (265; Civil and Environmental Engineering). Some respondents advised that, if workshops are used, care should be given to linking them to other courses and program activities, for example by having "students incorporate this [material] into an on-going course (e.g., in policy, resource management, human-environment systems)" (58; Geography).

Various traditional interactive delivery approaches for ethics (e.g., discussion or small group exercises) were rated as fairly effective, although read-write, reflection, lecture, and formal written assignments were not evaluated as very effective (Table 7). Respondents felt that activities that use real examples would be the most effective, especially activities that permit interaction among students. These include case studies, service learning, and interactions with professionals. Case studies can "provide multiple perspectives… of those issues students really care about… local, national and global" (376; Ecology). They can "explore value dimensions simultaneous to political and scientific dimensions" (479; Juris Doctorate). Interaction with "non-academic professionals outside of the classroom" (135;

Table 7 Respondents' evaluation of the effectiveness of different instructional techniques

Technique	Mean[a]	SD	% V − E[b]	% N − M[c]
Case-based learning	4.0	0.8	77.8	3.4
Problem-based learning	3.9	0.8	73.8	5.0
Facilitated classroom discussion of case studies	3.8	0.8	69.3	5.2
Real-life service-learning projects for clients external to the university	3.7	1.0	59.4	13.2
Instructor-led/guided discussions that progress toward a certain end	3.6	0.8	57.9	5.2
Small group exercises	3.6	0.8	58.2	8.3
Interaction with non-academic professionals in the classroom	3.5	1.0	52.3	14.0
Role-playing in scenarios	3.4	1.0	47.6	19.6
Student-led/exploratory approaches without pre-determined endpoints	3.4	1.1	51.1	20.3
Formal debates between students	3.2	1.0	39.0	24.9
Discussion centered around students' personal views on ethics issues	3.1	0.9	33.2	25.7
Story-telling	3.0	0.9	29.8	31.4
Personal reflective writing assignments	2.9	0.9	27.0	31.9
Out of class reading and classroom discussion of ethics readings	2.9	0.9	24.2	32.4
Individual learning through reading and writing	2.8	0.9	20.0	36.7
Formal written essays or papers	2.8	0.9	19.0	37.9
Lecture-based learning	2.7	0.8	13.4	40.4

[a] Scale: 1 = Not at all, 2 = marginally, 3 = moderately, 4 = very, 5 = extremely

[b] % V − E = percent marking 4 or 5 on the scale (very or extremely effective)

[c] % N − M = percent marking 1 or 2 on the scale (not at all or marginally effective)

Ecology) is preferable to lecture, because "so often in academics the nuance is lost and the economic/social constraints are viewed as less than urgent" (93; Earth Science). "Community-engaged service learning with community partners" also provides an opportunity to discuss "real-world field-based situations where ethically related issues/questions might arise" (315; Forestry).

Discussion

Respondents in our survey clearly acknowledged that IESPs deal with fractious problems, and they recognized many challenges of conducting policy-relevant science. Therefore, they largely agreed that students should be trained in social ethics topics and skills to help them engage effectively with such problems. This sentiment is consistent with calls in recent educational literature to broaden the scope of ethics training to include scientists' social responsibilities (duBois and Dueker 2009) and the complex relationships between science and society (McCormick et al. 2012). Thus, the answer to RQ1 is that social ethics are, with few exceptions, considered highly important by faculty and administrators in IESPs.

It is of interest, however, that some respondents equated "ethics" with RCR. This view led them either to assert that ethics is not relevant to their programs or to believe that—in the absence of ethical conduct violations—there is no real need to change the way they deliver their programs. McCormick et al. (2012) also found limited appreciation for the scope of ethics in the life sciences, with less than one-third of scientists saying that their own research has "direct ethical and social implications." Perhaps this indicates that scientists tend to think and are typically taught that science is objective, value-free, and separate from the world of decision making. In such a view, the relevant scope of ethics is restricted to matters of professional conduct. This suggests a need to be careful in describing educational materials and resources related to social ethics so that they are identified appropriately. We recommend using consistent terminology, such as "social ethics" (Herkert 2005) to distinguish the scope of topics from RCR.

Our second research question asked whether there were differences in view about social ethics across IESP topic areas. Mean importance ratings attached to topics and skills were quite similar across IESP focal areas. In retrospect, this may not be surprising, as by definition the programs we studied focus on environmental issues and tend to be policy-relevant and applied programs. (This conclusion is supported by the finding that only 2 % of respondents said that stakeholder engagement is not a priority in their program.) This consistency—across programs that ranged from environmental science and engineering, to urban planning and environmental policy, to sustainable development—suggests that there is a collective demand for ethics materials that can be incorporated into program offerings.

Despite the recognition of the importance of the topics and skills of social ethics, delivery of such material (RQ3) is still largely ad hoc and not systematic. Instruction in ethics is typically confined to individual classes or faculty members. Consistent with reports by Anderson et al. (2012) and Li and Fu (2012), respondents tended to describe short courses or on-line training in RCR. Thus, our findings coincide with

Børsen et al.'s (2013) claim that, generally, graduate students' education in social ethics is lacking. Because of this, IESPs produce students who have a limited understanding of the complexity of the ethical aspects of social systems in which they will work as scientists or resource managers (Boyle 2004). There are notable exceptions, however, as evidenced by those few respondents who described programmatic, thoughtful delivery of a range of social ethics content integrated throughout the curriculum. Given the demand we found for ethics material and the recognition of challenges in delivering such material, concerted efforts should be made to share successful examples of courses and activities.

Assessment is an area where substantial strides can be made. When conducted, assessment of student competence in social ethics was determined by individual instructors and generally based on written materials or exams, despite the preference seen in the survey for active learning activities to expose students to social ethics content. Almost no respondents described using rubrics to parse out competence in different areas of social ethics. Moreover, less than 20 % of the respondents in our study were certain that assessment is conducted at all. This may be a reflection of the status of ethics instruction as ancillary to the primary business of IESPs. The open-ended responses suggested that some instructors used standards of good reasoning in evaluating the essays, journals, and other ethics-related assignments, but no community-wide standards for assessing social ethics instruction are applied consistently across IESPs.

Our study reinforced conclusions about the primary challenges and barriers to addressing social ethics (RQ4), namely that there is extreme pressure to focus on science content while reducing overall time to degree. In this context, despite awareness about the importance of social ethics, it typically takes second stage to other material. This tendency is exacerbated by the fact that faculty have little ethics training (Eisen and Berry 2002; Herkert 2005; Wolpe 2006) and question their own qualifications to teach social ethics (McCormick et al. 2012).

We were encouraged that many respondents felt social ethics material is of interest to their students. However, many noted that students may have simplistic notions of ethical reasoning and therefore would benefit from structured frameworks that help them think through and critique different positions they might take. The difficulties associated with requiring students to take courses in philosophy or humanities highlight the need to develop and disseminate materials that can be integrated into IESP courses and that can be used by IESP faculty to productively and confidently engage their students.

In terms of delivery (RQ5), both case studies and problem-based learning were favored. Given respondents' reservations about expertise and time, we recommend that case studies be used, as materials can be structured to highlight key dimensions of a problem, and students can explore how their own approaches are similar to or different from what actually materialized. Case studies can be designed to highlight when values conflict, which promotes critical thinking (Halx and Reybold 2006), and they can be designed to progress from less to more complex examples, which leads to greater overall learning (Spelt et al. 2009). For some programs, especially where there is more available time and expertise, problem-based learning could be more appropriate. In problem-based learning—where students tackle an on-going

problem, often in collaboration with external stakeholders or clients—there is more opportunity to explore firsthand the nuances and ambiguities associated with social ethics. However, if they choose problem-based learning, faculty must be comfortable with adapting in real time and dealing with unanticipated turns in potentially politically or emotionally charged situations.

Study Limitations

Although we gathered input from a large cross-section of IESPs, our survey had a low response rate (14.4 %). It is possible—even probable—that findings reflect the views of those who are most interested in the study's topic. Additionally, minimizing respondent burden in the survey led us to treat each topic briefly. For instance, our broad questions about delivery and assessment give a general sense of the current state of affairs in IESPs, but do not provide much depth about particular approaches to either delivery or assessment. It is also worth noting that, although we did not observe differences in the importance of social ethics topics and skills across IESP topic areas, the study was not designed to provide insight into how each general topic or skill might specifically manifest in different IESPs.

Conclusion

The literature that concerns the education and training of the next generation of environmental scientists emphasizes the need for systematic attention to the ethical dimensions of the practice and application of environmental science. Although instruction in RCR addresses some of this need, it typically neglects the crucial roles of values and norms in framing scientific research and structuring its uptake by non-scientists, including managers and policymakers. These ethical elements constitute what we have called *social ethics*, a domain distinct from RCR but still critical to the successful engagement of future environmental scientists with the fractious socio-environmental problems they will face in their careers. While widely acknowledged as important, the literature indicates that social ethics is not broadly or systematically integrated into IESPs.

In this article, we have reported the results of a survey designed to assess the views of faculty members in United States IESPs concerning the importance of social ethics topics and skills, the extent to which these topics and skills are currently included and assessed within IESPs, and the effectiveness of various modes of delivering these topics and skills to graduate students in IESPs. Our survey results are consistent with the indications from the graduate education literature—most respondents agreed that social ethics are a key part of the training of future environmental scientists, but that there are various challenges in the way of successfully integrating them into academic programs, including lack of expertise and lack of time. Although daunting, these challenges are surmountable, and our survey provides indications of how a curriculum might be designed to overcome them. The significant threat posed by fractious socio-environmental problems

demands that we do what we can to produce responsible and accountable environmental scientists.

Compliance with Ethical Standards

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

Informed Consent Informed consent was obtained from all individual participants included in the study.

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