Collaborative Research: Graduate Ethics Seminars for Future Geospatial Technology Professionals

Project description

This project is designed to develop, implement, evaluate, and disseminate a model curriculum for seminars in graduate degree programs with specializations in Geographic Information Science and Technology (GIS&T). As explained below, geospatial ethics bear many similarities to ethical issues that arise in computer science, yet comparatively little research is available to guide the development of ethics education materials that are responsive to the specific needs of GIS&T graduate programs and geospatial professionals.

Our goals are to:

1. Cultivate the ability of current and future GIS&T professionals to recognize and anticipate ethical issues posed by applications of geospatial technologies;
2. Strengthen current and future practitioners’ moral reasoning abilities;
3. Ensure graduate students’ compliance with standards of ethical practice in the conduct of practitioner interviews and case study development; and
4. Catalyze incorporation of formal ethics education within graduate programs of geography with specializations in GIS&T in the U.S. and beyond.

To achieve these goals, we propose to:

1. Convene a workshop of applied ethicists and GIS&T domain experts to develop a model curriculum for a graduate seminar that emphasizes students’ engagement with practicing GIS&T professionals.
2. Produce digital courseware that embodies the model curriculum in a form that can be readily implemented in institutional learning management systems. The courseware will include HTML documents that present the seminar syllabus, bibliographic links to assigned readings, interview protocols, case studies that illuminate ethical challenges confronting GIS&T professionals, and digital video recordings of invited guest presenters.
3. Institute ethics seminars at three institutions with leading GIS&T graduate programs. The seminars will be offered locally and jointly (via synchronous and asynchronous Web-enabled communications), and will enroll both current and aspiring GIS&T professionals.
4. Perform a formative evaluation during the curriculum development process, then revise the curriculum and courseware accordingly. Perform a summative evaluation of the project’s effectiveness in fulfilling the goals listed above.
5. Promote the seminars and courseware nationally and internationally. Seminars will be open for participation by member institutions of the University Consortium for Geographic Information Science (UCGIS) and the Worldwide Universities Network (WUN). Courseware will be freely available for reuse by institutions worldwide, including members of the UNIGIS network. Cases will be deployed in the outreach and professional development initiatives of the Association of American Geographers (AAG), the GIS Certification Institute (GISCI), and other professional societies on request (see accompanying letters of support).
Literature review

Emergence of a “GIS Ethics”

Governments, militaries, commercial enterprises, and other interests have relied on maps and mapping for centuries and upon aerial surveillance since World War I. Computerized geographic information systems, digital remote sensing, and satellite navigation systems are relatively recent developments, having emerged between the 1960s and 1990s. As these new technologies matured and their applications became widespread in the late 1980s and early 1990s, scholars and practitioners began to express concerns about the ethical implications of their use.

Brian Harley (1988) was in the vanguard of scholars who questioned the assumption that maps are impartial and value-neutral depictions. By 1991, he challenged map makers to consider whether there could be “an ethically informed cartography, and if so, what should be its agenda?” (Harley, 1991, p. 13). At about the same time, Pickles (1991) highlighted the use of GIS as a surveillance technology, while Smith (1992) alleged that the makers and users of geospatial technologies were complicit in the killings associated with what he considered to be a morally questionable Gulf War. By 1995, a substantial literature focused on ethical and epistemological critiques of GIS and related technologies had appeared (e.g., Pickles, 1995), and a widening gulf of misunderstanding and mistrust had separated critical scholars from proponents and practitioners of GIS and related technologies (Schuurman, 2000).

Meanwhile, GIS began to show signs of coalescence into a distinct (if heterogeneous) profession. Among the earliest considerations of professional ethics in cartography and GIS was an “ethics roundtable” published in 1990 (McHaffie, Andrews, Dobson, & others, 1990). Contributors identified implications of inaccurate maps and data, intellectual property issues, and conflicts of interest as important ethical issues. Soon thereafter, Monmonier (1991, 1996) pointed out ways in which maps can be used to mislead decision-makers and the public, and proposed design guidelines to foster ethical practice by cartographers. By 1993, Craig had laid the groundwork for a GIS Code of Ethics (Craig, 1993). Onsrud (1995) recommended that the moral reasoning of GIS professionals in response to a set of “ethical conflict scenarios” be surveyed as a way to gauge the extent to which moral consensus about GIS practice exists. A code of conduct derived from “observation and analysis of current practice contexts and moral conditions,” Onsrud (1995) wrote, should be “evaluated and honed by continuously reassessing (the Code’s) conformance with theory” (p. 94). The involvement of graduate students in the observation and analysis of professional practice, as well as in the harvesting of authentic “ethical conflict scenarios,” is one intended outcome of the proposed project.

Compliance with a GIS Code of Ethics (written primarily by Craig) is included among the requirements for certification as a “GIS Professional” (GISP) by the GIS Certification Institute (GISCI), a program that began accepting applications in 2004. GISCI’s Ethics Committee now seeks to compile a collection of authentic case studies to help GISP develop moral reasoning skills (Craig, 2006). Meanwhile, following the lead of more established fields like Computer Science, the University Consortium for Geographic Information Science (UCGIS) has developed the first edition of a Geographic Information Science and Technology (GIS&T) Body of Knowledge (DiBiase, DeMers, Johnson, Kemp, Luck, Plewe, & Wentz, 2006). Published by the AAG, the GIS&T Body of Knowledge highlights such ethical and legal issues as privacy, access, intellectual property, and others, among the 329 topics that define the GIS&T knowledge domain. “Ethical aspects” is included among the “core” units that UCGIS recommends as part of every geospatial certificate and degree program curriculum. The engagement with “GIS Ethics” has now been codified for geospatial educators as well as practitioners.
As GIS&T continues to coalesce into a coherent field, emerging technologies introduce increasingly worrisome ethical challenges, including such location-based services as “human tracking.” Dobson and Fisher (2003) challenge society to “contemplate a new form of slavery characterized by location control” (p. 47), arguing that “…the countless benefits of [location-based services] are countered by social hazards unparalleled in human history” (p. 47). Clearly, there is an urgent need for graduate-level ethics education that bridges the gap between critical theory and professional practice in GIS&T. Moreover, the readiness of the GIS&T field to respond to this need is greater than ever before. Lessons learned in allied fields will help educators respond effectively.

**Computer Ethics**

The emergence of a “GIS Ethics” echoes earlier developments in Computer Science and Information Science. Bynum (2001) outlines the origins of Computer Ethics beginning in Wiener’s “cybernetics” of the early 1940s. Wiener’s *Human Use of Human Beings* (1950) presaged concerns similar to those voiced by geographers and geographic information scientists a generation later. Parker’s “Rules of Ethics in Information Processing” (1968) led to the ACM’s first Code of Professional Conduct in 1973. Key ethical issues in Information Science, including privacy, accuracy, property, and access (Mason, 1986), correspond closely with ethical and legal issues outlined in the *GIS&T Body of Knowledge*. However, the unique characteristics of geospatial information that justify geographic information science as a distinct research field (Goodchild, 1992) also pose unique ethical problems (e.g., human tracking and geoslavery). The “new university courses, research centers, conferences, journals, articles and textbooks” (Bynum, 2001, p. 111) concerned with Computer Ethics that appeared in the 1990s represent the kind of enthusiastic response to a societal concern that the younger GIS&T community and its stakeholders has begun more recently to demonstrate.

**Lessons from Computer Ethics education**

The Association of Computing Machinery (in collaboration with the IEEE and other organizations) has issued a series of recommended curricula for undergraduate degree programs in Computer Science since 1968. From the outset, the recommendations included topics related to ethics and social issues. By 1994, however, observers concluded that the recommended curricula “fell short of providing sufficient detail and guidelines about how to implement [understanding of the social and ethical context of computing] within the curriculum” (Martin & Weltz, 1999, p. 7). In response, NSF funded a project called ImpactCS to “define the core content and methodology for integrating social impact and ethics topics across the computer science curriculum” (Martin & Weltz, 1999, p. 7). Following this effort, the *Computing Curricula 2001* (ACM/IEEE 2001) recommended “Social and Professional Issues” as one of fourteen knowledge areas, including the core unit “SP4 Social and Ethical Responsibilities.”

To qualify for accreditation by ABET’s Computing Accreditation Commission, undergraduate degree programs in computer science must demonstrate that there is “sufficient coverage of social and ethical implications of computing to give students an understanding of a broad range of issues in this area” (Computing Accreditation Commission, 2004, p. 4). A 2005 survey of a quarter of the ABET-accredited computer science programs revealed that 55 percent of them meet this standard by teaching their own computer ethics course, 30 percent meet the standard by incorporating discussions of social and ethical implications of computing into other computer science courses, and only 15 percent of them outsource ethics to other academic departments, typically philosophy (Quinn, 2006b). In other words, addressing ethical issues “in house” is the norm for accredited undergraduate computer science programs. We believe that the same should be true of graduate programs that specialize in GIS&T. As Davis (1990, 37)
points out that “being concerned about the ethics of one’s profession is a professional virtue. A professional [GIS&T] teacher can teach that virtue by example in a way a philosopher cannot.”

Research articles that describe, prescribe, and evaluate Computer Ethics education are plentiful. Many describe teaching strategies, including lectures, guest speakers, field trips, tests, student presentations and debates (e.g., Wahl, 1999); face-to-face and computer mediated discussion (e.g., Sanders, 2005; Grodzinsky, Gehringer, King, & Tavani, 2004), interactive tutorial and decision support software (e.g., Goldin, Ashley, & Pinkus, 2001; Robbins, Wallace, and Puka, 2004), and student evaluation methods including rubrics (Moskal, Miller, & King, 2002) and peer review (e.g., Grodzinsky & others, 2004). A common theme in the Computer Ethics education literature is the goal of giving the students the opportunity to transform themselves. As Martin and Holz put it: “Our belief is that ethics cannot be taught; rather what can be taught is a framework for evaluating ethical dilemmas and making decisions. In accepting the premise that technology is value-laden, we stress the need to teach a methodology of explicit ethical analysis in all decision-making related to technology” (Martin & Holz, 2005, section 1.2).

In the context of our project goals, a common shortcoming of the pedagogical approaches reported in the Computer Ethics literature is the apparent gap between formal higher education and professional practice. Other than their instructors, it appears that most undergraduate students in Computer Ethics classes have little or no direct contact with computing or information systems professionals or their places of work (see Bittner & Hornecker, 2005, for a noteworthy exception). From his review of professional ethics teaching, Preston (1998, p. 60) concludes that “only through basing it in real experience of ethical issues will Professional Ethics develop or be of value to the student” (p. 62). Similar arguments are found in the business ethics literature. For example, Davis and Welton (1991, p. 463) observe that “…enhancement of ethical behavior comes from multiple exposures to the business environment…”, while Furman (1990, p. 36) claims that “business ethics must be grounded in economic, social, political and cultural realities and not solely in abstract forms of reasoning.” As stated earlier, this project seeks to develop a model curriculum that will emphasize interactions among graduate students and practicing professionals.

Dark and Winstead (2005, p. 27) argue convincingly that the overarching goal of ethics education should be to advance students’ moral development and reasoning. They, and many others, refer to Kohlberg’s theory of moral development, which predicts that the capacity for moral reasoning develops over time, in parallel with individuals’ cognitive development, through a series of six stages (Kohlberg & Hersh, 1977). Dark and Winstead describe the cognitive, affective, and social aspects of morality, and argue that ethics education must engage all three aspects if it is to be effective in advancing students’ moral development. They argue that ethics pedagogy grounded in constructivism and critical theory is most likely to be effective in this way. “A constructivist approach,” they explain, “will provide opportunities for experience and follow up with opportunities for debriefing, interaction and reflections … a constructivist classroom requires students to produce (construct) products [e.g., case studies] that reflect their individual and/or collective thinking” (Dark & Winstead, 2005, p. 30). Moreover, despite Davis’ (1990, 34) warning that “teaching moral theory has no effect on ethical judgment” [author’s emphasis], we accept one reviewers’ argument that grounding moral reasoning training in ethical theory could benefit students by improving their ability to articulate outcomes of that training, and to communicate outcomes to others.

GIS Ethics education

Unlike Computer Science, most of the academic disciplines that offer degree programs with specializations in geographic information science or geospatial technologies are not specifically accredited. For this reason, GIS&T curricula vary widely, and few require formal ethics training.
Consequently, research publications on ethics education in the context of GIS&T are rare (an important exception is Edson and colleagues (2001), graduate students at the University of Wisconsin whose seminar project was to propose a Code of Ethics for GIS Professionals). UCGIS’ *GIS&T Body of Knowledge* was developed in response to the perceived lack of breadth and depth of undergraduate, graduate, and professional curricula. While accreditation of GIS&T education is unlikely in the foreseeable future, interest in formal ethics education at the graduate level is evident.

In Fall of 2005, the University Consortium for Geographic Information Science sponsored a “Virtual Seminar” in which more than 50 students from five graduate programs (including the three institutions that are submitting this proposal collaboratively) shared presentations from guest speakers via desktop Web conferencing, contributed to Web-mediated asynchronous discussions, and participated in weekly local debriefing sessions (Penn State, 2005). The tenor and content of asynchronous discussions were consistent with the findings of Cappel and Windsor (1998), who provide empirical evidence of significant differences in the moral reasoning of information systems professionals and students. This experience has motivated the investigators to develop and evaluate an approach to the teaching and learning of GIS ethics that is grounded in professional practice, that authorizes students to take responsibility for their own learning, and that challenges them to produce and reflect upon works that make a useful contribution to their profession.

The following section outlines our plan to develop, implement, evaluate, and disseminate an seminar curriculum that will strengthen graduate ethics education for future leaders in the geospatial professions, while promoting awareness of ethical issues and the GIS Code of Ethics among practicing professionals.

**Project plan and timeline**

Research, evaluation, and dissemination milestones are outlined in the timeline below.

**Key outcomes** of the proposed research include:

1. **A model curriculum for graduate seminars** that explore the ethical implications of GIS&T;
2. **Digital courseware** that embodies the model curriculum in a form that can be readily implemented in institutional learning management systems, and that is freely available to potential adopters.
3. **Recurring ethics seminars instituted at three universities** within leading GIS&T graduate programs.
4. **Participation in virtual seminars and adoption of project courseware** by institutions, faculty members, and students across the U.S. and around the world.

**Model Seminar Curriculum**

The project will support a curriculum planning workshop in March 2008. Participants will include three GIS&T educators (Wright, DiBiase, and Harvey), a computer science educator and author of a leading computer ethics text (Quinn), three professional ethicists who specialize in practical and professional ethics (Davis, Huff, and Keefer), evaluation experts from the AAG (Solem and Cheung), and an instructional design specialist from Penn State’s e-Education Institute. Prior to the workshop, the project team will compile, share, and discuss relevant readings and existing case materials (see timeline below). During the workshop, participants will define educational objectives, identify existing educational resources as well as resources that need to be created, name prospective guest presenters, and review protocols for students’ practitioner interviews. Students’ engagement with practicing GIS&T professionals will be emphasized. Students will receive training in moral reasoning, as well as in ethical
standards of conduct in practitioner interviews and case study development. Students’ primary
deliverables will be case studies that illuminate ethical implications of geospatial technologies, grounded
in real or hypothetical scenarios derived from interviews. Other deliverables will include assessments of
practitioners’ awareness of the GIS Code of Ethics, and of potential ethical problems in their professional
practice.

Digital Courseware

After the workshop, the project’s instructional design specialist will prepare digital courseware that
embodies the model curriculum in a form that can be readily implemented in institutional learning
management systems. The courseware will include HTML documents that present the seminar syllabus
and bibliographic links to assigned readings; interactive quizzes that enable students to develop and self-
assess their moral reasoning abilities; and other digital documents including interview protocols, case
studies that illuminate ethical challenges confronting GIS&T professionals, and digital video recordings
of invited guest presenters. (Some presentations will be recorded in advance; others will be conducted
synchronously during the ethics seminars, and recorded for later viewing. At the conclusion of the project,
revised courseware will be made freely available to any user under terms of the Creative Commons
“Share Alike” license. The project instructional designer will acquire permissions for any copyrighted
intellectual property that is included in the courseware.

Case studies

In preparation for this proposal we conducted a preliminary search for case studies that illustrate ethical
problems associated with applications of geospatial technologies. We found very few. Onsrud (1995)
sketches three, but suggested several others in a paper that proposed a methodology to investigate
common practices among GIS&T professionals as well as their beliefs about the legality and ethically
implications of such practices. One of Onsrud’s cases considers geospatial data providers’ liability when
data products are used for engineering purposes; another the intellectual property rights of professional
surveyors in regards to derivative works produced and sold by local governments; a third, concern about
privacy raised when GIS consultants “geocode” diverse personal data to household locations. More recent
scenarios suggest ethical implications of positioning technology incorporated in many mobile phones, and
of location tracking devices intended to monitor or even restrict subject’s movements (Dobson and Fisher,
2003).

Our project will commence with a thorough search for and compilation of existing case studies. New
ethical scenarios produced in this project will be prepared in a manner consistent with published
guidelines for ethics education (e.g., Davis, 1997), including notes to help instructors lead students
through case-based analyses (e.g., Keefer & Ashley, 2001; Quinn 2006c). Case materials will derive from
graduate students’ interviews with GIS&T professionals. Cases will be deployed in the outreach and
professional development initiatives of the Association of American Geographers (AAG), the GIS
Certification Institute (GISCI), and other professional societies on request (see attached letters of
support).

Ethics Seminars

A key goal of the project is to institutionalize ethics education within graduate programs at Oregon State,
Penn State, and Minnesota. To make ethics education available to every Master’s degree seeking student,
seminars will be offered at the three project institutions at least once every two years. Following the
experimental offering of the 2005 Virtual Seminar, the project team proposes to commence regular joint
offering of the Virtual Seminar in Ethics for GIS Professionals in Fall 2008. As in 2005, the 2008
Seminar will use a blended delivery approach that combines three elements:
- Local, synchronous, weekly meetings of seminar participants at each institution, on campus or via teleconference;
- A learning management system (http://angel.psu.edu) for document sharing and asynchronous discussion involving students and instructors at multiple participating institutions, as well as guest presenters and visitors.
- Web conferencing technology for weekly live audio and video presentations and discussion.

![Live presentations Web conferencing](image1.png)

**Figure 1:** Three components of the educational infrastructure used in the experimental 2005 Virtual Seminar in Ethics for GIS Professionals.

Penn State will manage provide the Web conferencing and learning management system infrastructure, although other institutions will be free to implement courseware within their own systems.

Seminars will attract a variety of current and aspiring GIS&T professionals:

- Oregon State’s ethics seminar serves resident students seeking M.Sc. and Ph.D. degrees in Geography, Oceanography, Marine Resource Management, Soil Science, and Forestry, as well as a graduate and professional certificates in GIScience.
- The University of Minnesota’s ethics seminar primarily serves resident students who are pursuing the Department of Geography’s on-campus Master of GIS (MGIS) professional degree.
- Penn State’s seminar serves students seeking its professional MGIS degree online, from homes and offices across North America.
Graduate students

Graduate students who pursue graduate degrees with specializations in GIS&T come from diverse backgrounds. Most of those enrolled in the professional masters programs at Penn State and Minnesota are experienced practitioners with full-time jobs in local government planning and public works offices, state environmental management agencies, energy utilities, and federal national security agencies and their contractors, among many other market sectors. Other students will bring only academic experience to the seminar, but will benefit from discussion and teamwork with practitioner colleagues. Insofar as they self-select for enrollment, we assume that students will share a concern about professionalism in GIS&T as well as a disposition to critical engagement with the social implications of geospatial technology.

Students will be expected to play active roles in the seminar. They will conduct multiple interviews with practicing geospatial professionals and managers on-site in government agencies and businesses involved in geospatial technology projects. They will learn to how to assess the awareness and attitudes of practitioners toward GISCI professional certification and its associated Code of Ethics. (Involvement of human subjects in research has already been approved at Penn State, and will be approved by all universities’ Institutional Review Boards prior to the project start date, October 1, 2007.) Seminar activities will be wide ranging. Students will solicit case studies of ethical problems in professional practice, document the institutional, personal, political, and economic factors that thwart simple solutions, and investigate pertinent ethical principles (See IRB-approved interview protocol included as addendum). Cases will be discussed in seminar meetings and presented as virtual posters in an online ‘poster gallery’ that will be made part of the ethics seminars. In preparation for interviews, students will examine the GISCI Code of Ethics, Craig’s (1993) original proposal, as well as research articles that deliberate the potentials and pitfalls of geospatial technologies and ethics codes. Students will work in teams to draft reports to GISCI including assessment data and case studies to be used for the professional development of current and aspiring GISP.

The Departments of Geography at Oregon State, Penn State, and Minnesota, as well as the AAG, are closely allied with agencies and firms that provide internship and employment opportunities to graduates. We will leverage these existing networks to provide opportunities for interaction among seminar students and practitioners. We expect that our networks will grow as future seminar participants seek out new interviewees and case studies.

Participation and Adoptions

The Virtual Seminar will not be restricted to participants at the Co-PI’s home institutions. Member institutions of the University Consortium for Geographic Information Science (UCGIS) and the Worldwide Universities Network (WUN) will be encouraged to participate at no cost. Potential adopters will not be required to conduct all or part of their seminars online, however. The courseware will be equally applicable to face-to-face, blended, and online instructional delivery. The diversity of delivery methods employed will enhance the transferability of courseware to other institutions.

Based on participation in the 2005 experimental offering, and response to presentations since then, we expect many other graduate programs in the U.S. and abroad to participate in our virtual seminars and/or to adopt our courseware (see Dissemination Plan below, and letter of support from the Worldwide Universities Network and UNIGIS network).
**Project management**

The project team will meet monthly, usually by desktop audio/video conference hosted by Penn State. Penn State will also create a project Web site at which meeting minutes, a project description, and project deliverables will be posted.

<table>
<thead>
<tr>
<th>Month</th>
<th>Research and dissemination activities</th>
<th>Evaluation activities</th>
<th>Locations/media</th>
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<tbody>
<tr>
<td>Oct 2007</td>
<td>Create project Web site</td>
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<td>Teleconference</td>
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<tr>
<td></td>
<td>Search, compile existing case studies and courseware</td>
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<tr>
<td>Nov 2007</td>
<td><strong>Project Team and Advisory Board</strong> compile bibliographies on ethics and ethical issues in GIS&amp;T</td>
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<td>Teleconference</td>
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<td></td>
<td>Search, compile existing case studies and courseware</td>
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<tr>
<td>Dec 2007</td>
<td><strong>Project Team and Advisory Board</strong> exchange readings on ethics and ethical issues in GIS&amp;T</td>
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<td>Teleconference</td>
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<td></td>
<td>Distribute compiled case studies and courseware</td>
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<tr>
<td>Jan 2008</td>
<td><strong>Project Team and Advisory Board</strong> discuss reading exchange</td>
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<td>Teleconference</td>
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<tr>
<td>Feb 2008</td>
<td><strong>Project Team and Advisory Board</strong> set agenda for Curriculum Workshop</td>
<td>Prepare evaluation plan, including pre-test, post-test, and interview protocols</td>
<td>Teleconference</td>
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<td>Identify possible seminar presenters</td>
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<td>APPE conference</td>
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<td>Association for Practical and Professional Ethics – panel discussion on cases</td>
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<tr>
<td>Mar 2008</td>
<td><strong>Curriculum Workshop</strong> (all project personnel)</td>
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<td>Two-day, face-to-face meeting, in Washington DC</td>
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<td>Define educational objectives; outline Seminar curriculum, including presentations, readings, student interviews of practitioners</td>
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<td>Apr 2008</td>
<td>Recruit seminar presenters</td>
<td>Procedural evaluation</td>
<td>Association of American Geographers annual meeting</td>
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<td>Develop seminar courseware (syllabus, orientation materials, assignments, interview protocols)</td>
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<td>Promote seminar in AAG panel discussion</td>
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<td>May 2008</td>
<td>Recruit participating academic programs</td>
<td>Report procedural evaluation findings</td>
<td>Teleconference</td>
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<td>Develop seminar courseware</td>
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<td>Promote seminar in AAG panel discussion</td>
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<tr>
<td>Jun 2008</td>
<td>Recruit participating academic programs</td>
<td>Pilot student pre- and post-tests</td>
<td>UCGIS Summer Assembly</td>
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<td>Demonstrate seminar courseware</td>
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<td>Conduct workshop for seminar participants</td>
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<td>Jul 2008</td>
<td>Recruit GIS&amp;T professionals for student interviews</td>
<td>Progress evaluation</td>
<td>Teleconference</td>
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<tr>
<td>Aug 2008</td>
<td>Recruit GIS&amp;T professionals for student interviews</td>
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<td>Month</td>
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<tr>
<td>Sep 2008</td>
<td>Finalize syllabus&lt;br&gt;Rehearse seminar presenters&lt;br&gt;Brief participating faculty and students</td>
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<tr>
<td>Oct 2008</td>
<td>Ethics seminar commences&lt;br&gt;Seminar participant pre-test</td>
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<td>Hybrid mode: Web conferences + face-to-face local sessions</td>
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<td>Nov 2008</td>
<td>Ethics seminar continues&lt;br&gt;Advisory Board members participate in at least one seminar session</td>
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<td>Hybrid mode</td>
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<td>Dec 2008</td>
<td>Ethics seminar concludes&lt;br&gt;Seminar participant post-test</td>
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<td>Hybrid mode</td>
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<tr>
<td>Jan 2009</td>
<td>Compile student-developed case studies&lt;br&gt;Interview select students, faculty members and practitioner</td>
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<td>Teleconference</td>
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<td>Feb 2009</td>
<td>PI and Advisory Board Briefing on seminar assessment&lt;br&gt;Develop action plan for revising seminar curriculum and courseware&lt;br&gt;Edit case studies&lt;br&gt;Association for Practical and Professional Ethics panel discussion&lt;br&gt;Analyze participant data</td>
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<td>Teleconference</td>
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<td>Mar 2009</td>
<td>Revise seminar courseware in response to assessment data&lt;br&gt;Deploy revised seminar courseware in Open Educational Resources interface&lt;br&gt;Present case studies to Advisory Board for review and comment&lt;br&gt;Procedural evaluation: present provisional results of project evaluation</td>
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<td>Teleconference</td>
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<td>Apr 2009</td>
<td>Demonstrate revised seminar courseware in Open Educational Resources interface&lt;br&gt;Revise case studies in response to Advisory Board comments&lt;br&gt;Prepare institutional course proposals for permanent ethics seminars&lt;br&gt;Association of American Geographers annual meeting</td>
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<td>May 2009</td>
<td>Submit edited case studies to GISCI&lt;br&gt;Prepare institutional course proposals for permanent ethics seminars</td>
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<td>Teleconference</td>
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<td>Jun 2009</td>
<td>Demonstrate revised seminar courseware in Open Educational Resources interface&lt;br&gt;Schedule and recruit participants for next seminar offering&lt;br&gt;UCGIS Summer Assembly</td>
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<td>Jul 2009</td>
<td>Prepare articles for publication&lt;br&gt;Promote and disseminate courseware and case studies&lt;br&gt;Teleconference</td>
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<td>Aug 2009</td>
<td>Prepare articles for publication&lt;br&gt;Promote and disseminate courseware and case studies&lt;br&gt;Teleconference</td>
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<tr>
<td>Sep 2009</td>
<td>Submit final report and articles&lt;br&gt;Project evaluation report&lt;br&gt;Teleconference</td>
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Project team

**Dawn Wright** (PI) will serve as faculty supervisor of the Oregon State University’s offering of the proposed 2007 Virtual Seminar in Ethics for GIS Professionals. She is the director of Oregon State University Geographic Information Science Certificate program (certificates for undergraduate, graduates, and working professionals), as well as a participating faculty member in Oregon State’s IGERT doctoral program in Ecosystem Informatics (which is hoping to include an emphasis in ethics education). As a member of the UCGIS Education Committee, Dr. Wright participated in the 2005 Virtual Seminar, leading a cohort of 10 Oregon State M.S. and Ph.D. students, and coordinated an earlier UCGIS Virtual Seminar in 1998 (Wright, 1999).

**David DiBiase** (Co-PI) will serve as project manager and as faculty supervisor of the Penn State offering of the proposed 2007 Virtual Seminar in Ethics for GIS Professionals. He manages Penn State’s online Master of GIS (MGIS) degree program. As chair of UCGIS’ Education Committee, DiBiase organized the 2005 Virtual Seminar. He is managing editor of the first edition of the UCGIS *GIS&T Body of Knowledge*. DiBiase directs Penn State’s e-Education Institute. He has gained practical experience in inter-institutional curriculum development as Co-PI of the “DialogPLUS” project that is supported by NSF as part of its Digital Libraries in the Classroom program. As founding editor of the journal *Cartographic Perspectives*, DiBiase solicited and edited essays on cartographic ethics in the early 1990s.

**Francis Harvey** (Co-PI) will serve as faculty supervisor of the University of Minnesota’s offering of the proposed 2007 Virtual Seminar in Ethics for GIS Professionals. He wrote with Ben Gross a commentary in *The Information Society* (12)73-82 on The Durango Declarations Forum, an early attempt to articulate principles for the consideration of social principles in computer science research and practice. Dr. Harvey will serve as facilitator for the participation of over 70 in-resident students at the University of Minnesota’s Masters of Geographic Information Science program and students from geography, urban policy and planning, forestry, and conservation biology programs.

**Michael Solem** (Co-PI) will lead the project evaluation. As Educational Affairs Director at the Association of American Geographers (AAG), Dr. Solem has extensive experience in measuring the quality of university education and research programs, using both quantitative and qualitative research methods. He currently directs Enhancing Departments and Graduate Education (EDGE) in Geography project, and is the external evaluator for the Geography Faculty Development Alliance (GFDA), both funded by the National Science Foundation.

**Michael Davis** (Project Personnel) is Senior Fellow at the Center for the Study of Ethics in the Professions and Professor of Philosophy, Illinois Institute of Technology, Chicago. Since 1991, he has held—among other grants—three from the National Science Foundation to integrate ethics into technical courses. Davis has published more than 120 articles (and chapters) and authored seven books, including *Thinking Like an Engineer* (Oxford, 1998); *Ethics and the University* (Routledge, 1999); and *Profession, Code, and Ethics* (Ashgate, 2002).

**Chuck Huff** (Project Personnel) is Professor of Psychology at St. Olaf College. He teaches classes in social psychology, the psychology of good and evil, the psychology of religion, research methods, and ethical issues in software design. He has published research on moral reasoning, computing and education, gender and computing, and social aspects of electronic interaction. He was a member of the panel that designed the curriculum standards in *Social and Professional Issues* for the ACM/IEEE Computing Curricula 2001.
Matthew Keefer (Project Personnel) is Associate Professor and Chair of the Division of Educational Psychology, Research and Evaluation at the University of Missouri at St. Louis. His research and scholarship focus on cognitive studies in teaching and moral education. Publications include articles in the fields of moral philosophy and moral psychology, discourse and argumentation studies, inquiry-teaching, and professional ethics.

Evaluation plan

As lead project evaluator, Dr. Solem will oversee both formative and summative evaluations. He and colleagues at AAG will monitor research procedures, assist with the planning and design of research instruments including pilot testing and validity assessments, and prepare a final summative report on the research and its broader implications for making improvements to ethics education in GIS&T.

Formative Procedural Evaluation

The evaluation team members will participate in monthly project meetings by teleconference and Web conference. In addition, in April 2008 and 2009, the evaluation team will interview all project personnel individually to assess the effectiveness of administrative and methodological processes. Supporting documents related to curriculum planning will be collected and reviewed. Formative evaluation reports will be delivered to project personnel in May 2008 and 2009.

Procedural evaluation will also include participation in pilot tests student pre- and post-test instruments and interview protocols.

At the conclusion of the Fall 2008 offering of the Virtual Seminar, formative evaluation will address the questions “What elements of the model curriculum were most and least effective? Why?” The evaluation team will analyze text postings in one of the seminar’s online discussion forums, as well as the results of a student satisfaction survey administered at the conclusion of the seminar. In addition, evaluators will conduct interviews with faculty participants. Results will include recommended revisions to the seminar curriculum and courseware prior to public release.

Formative Progress Evaluation

The progress evaluation will include periodic reviews of the courseware (see Timetable) to ensure that seminar resources are developed and tested in time to be deployed in Fall 2008. Evaluators will also monitor the recruitment of seminar participants, including students, faculty members, and guest presenters within and beyond the three universities represented in this project. The evaluation team will contact a sample of participants by telephone to assess their readiness and to identify their concerns. Concerns about the progress of the project, if any, will be discussed with project personnel during monthly project meetings.

Summative Evaluation

Summative evaluation will address the key evaluation questions outlined below.

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<th>Evaluation question</th>
<th>Measures</th>
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<td>1. What do students’ know, believe, and feel about potential ethical problems confronting GIS&amp;T professionals?</td>
<td>Pre-test administered to students (including students enrolled in GIS&amp;T programs but not in the ethics seminar), and to the practitioner participants</td>
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<td>2. How do the preconceptions of</td>
<td>Pre-test administered to students (including</td>
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<tr>
<th>Question</th>
<th>Method</th>
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<td>inexperienced students differ from those of experienced practitioners?</td>
<td>students enrolled in GIS&amp;T programs but not in the ethics seminar, and to the practitioners students recruit for interviews</td>
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<td>3. How effective is the seminar in strengthening students’ moral reasoning of abilities?</td>
<td>Pre-test and post-test administered to students enrolled in seminar</td>
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<td>4. How effective is the seminar in attracting graduate student enrollments? Which students are more likely to enroll, and why?</td>
<td>Enrollment counts at each participating institution in relation to the numbers of students eligible to enroll. Interview select eligible students who declined to enroll.</td>
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<td>5. Do students, faculty members, and GIS&amp;T professionals believe that ethics should be a required element of graduate education in GIS&amp;T?</td>
<td>Student’s online discussion forum; interviews select students (including students enrolled in GIS&amp;T programs but not in the ethics seminar), faculty participants, and practitioner participants.</td>
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<td>6. How effective is the project in attracting participation by students and courseware adoptions by faculty members at other institutions?</td>
<td>Seminar enrollment counts, email inquiries; responses at conference presentations; contact information submitted by users who download courseware</td>
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<td>7. In what ways do concerns about ethical practice differ across various GIS&amp;T labor market sectors?</td>
<td>Student discussion in online forum; interview select students and practitioners</td>
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<td>8. How relevant is the model curriculum to GIS&amp;T beyond the U.S.?</td>
<td>Interviews with international participants affiliated with WUN institutions</td>
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Pre- and post-tests will draw upon the work of Kohlberg (1969), Rest (1990), and Cappel and Windsor (1998). Project evaluators will employ multiple approaches to gauge the seminar’s impact of students’ knowledge, skills, and abilities. One established method for measuring changes in students’ moral reasoning abilities is the Defining Issues Test (DIT) (e.g., Staehr and Byrne, 2003). Although Rest (1990) characterizes the DIT test as the most widely used, reliable, and valid test of its kind, comments by NSF reviewers alerted us to the reported bias of the DIT test results associated with subjects’ political orientation. Mindful of this, the evaluation team will also incorporate elements of the Moral Judgment Interview (Elm and Weber, 1994), a qualitative technique for assessing a subject’s stage of moral development. Pilot studies of the pre- and post-test instruments, will be conducted prior to the Fall 2008 seminar session using graduate student and faculty volunteers who attend the 2008 UCGIS Summer Assembly.

Finally, the evaluation team will prepare a project evaluation report that presents data and findings in relation to the questions listed above. Results will be reported via the project web site, and via a publication in an appropriate peer-reviewed periodical.
Dissemination

Beyond the publications summarizing this project and its evaluation in peer-reviewed journals in GIScience, research geography, and applied geography journals, the project includes activities orientated to disseminating the materials produced during the project to a broad array of educators, professionals, and students.

AAG

The AAG will play a central role disseminating the results of the project, in three ways. First, our ethics case materials will be linked to a collection of graduate education resources under development for the aforementioned Enhancing Department and Graduate Education in Geography (EDGE) project. EDGE is creating materials that provide graduate students with exercises for improving skills in areas such as time and project management, course design, proposal writing, academic publishing, and career planning. EDGE resources will be used in professional development courses, workshops, and seminars for graduate students. The AAG plans to provide free copies of EDGE resources to every geography graduate program in the United States. Using EDGE as a springboard, the geospatial ethics education materials developed in this project will reach graduate students and programs nationwide.

The AAG will also promote this project and distribute the materials it produces through a geospatial workforce development project funded by the U.S. Department of Labor (DoL). DoL has funded the Geospatial Information Technology Association (GITA) and AAG to create a Geospatial Industry Workforce Information System (GIWIS) that will serve as a comprehensive “one-stop” online informational gateway for the geospatial workforce (including current and future professionals, workforce development experts, educators, and students). GIWIS provides an online career adviser for individuals seeking work in the geospatial industry by linking relevant workforce competencies to education and training programs. For instance, “Ethics Modeling” is a component of the geospatial workforce competency model developed by Gaudet, Annulis, and Carr (2001) and, as noted earlier, ethical issues frequently arise in spatial data analysis, system management, marketing, and other aspects of work in the geospatial industry. The AAG will incorporate the results of the proposed project into GIWIS as a strategy for communicating the role of ethics education in geospatial professional development. GIWIS will provide an efficient and extensive mechanism to engage GIScience employers and professionals in the work of the project.

Finally, the results of the project will be made available to upcoming workshops for early-career faculty through the Geography Faculty Development Alliance (GFDA). Aimed at early career faculty and advanced doctoral students, the key objectives of GFDA are to foster a culture of support and success for early career faculty, to help them understand the fundamental interconnections between their teaching and research, and to advance the scholarship of teaching and learning across the entire discipline (Solem & Foote 2004). Summer workshops held at the University of Colorado at Boulder with Professor Kenneth Foote as director have provided early career faculty and doctoral students in geography with resources and training related to teaching, research, and service. GFDA has also created a large network of faculty who continue to provide each other and their colleagues with support and further training in workshops held during the annual meetings of the AAG and National Council for Geographic Education. By training this cohort of faculty in methods of ethics instruction, they in turn can serve as mentors to graduate students seeking careers in the geospatial industry.

UCGIS

The University Consortium for Geographic Information Science (UCGIS) represents universities that play leading roles in the GI S&T research and development. UCGIS will sponsor workshops at its 2007 and
2008 Summer Assemblies to promote ethics education in graduate GIScience programs. The educational objectives of the ethics seminar to be planned, implemented, and evaluated in this project will be aligned with the core ethics unit in the UCGIS GI S&T Body of Knowledge, which will be the primary curriculum planning resource in graduate and professional GI S&T education.

**Results from Prior NSF Support**

**IIS-0229210; $939,853 (S$103,319 subcontract to Penn State), 02/01/2005–01/31/2006 (no-cost extension through 01/31/2007), M. Freeston (PI), D. DiBiase (Co-PI), Digital Libraries Supporting Innovative Approaches to Learning and Teaching in Geography.** NSF and the European Joint Information System Committee (JISC) funded this research and development project as part of their “Digital Libraries in the Classroom” initiative. The project combined the efforts of geographers, education specialists and computer scientists at the University of California at Santa Barbara, Penn State University, The University of Southampton, and Leeds University to develop and deploy reusable digital learning objects through the Alexandria Digital Library. Learning objects were implemented and assessed in classes in human geography, physical geography, and Earth observation (GIS and remote sensing), affecting hundreds of students at Penn State, Leeds, and Southampton. The project team developed a learning object design methodology involving collaborative concept mapping and an interactive “learning design toolkit.” The method was employed to design and produce several educational activities in Penn State’s online Master of GIS degree program. An object developed at Penn State concerned with cultivating academic integrity in e-learning was subsequently deployed at Leeds and Southampton.

**EIA-011359; $507,965, 10/1/01-2/28/05, D.J. Wright (PI), ITR/IM/Digital Government: Infrastructure for Data Sharing, Spatial Analysis, Resource Decision-Making, and Societal Impact: The Oregon Coastal Atlas.** This award funded the development of the Oregon Coastal Atlas, an interactive map, data, and metadata portal for coastal resources managers and scientists, with additional outreach sections for the general public. The portal enables users to obtain data sets, but also to understand their original context, and to use them for solving a spatial problem via online tools. The design of the atlas draws from the reality that resource decision-making applications require much more than simple access to data. Resource managers commonly make decisions that involve modeling risk, assessing cumulative impacts and weighing proposed alterations to ecosystem functions and values. These decisions involve pulling together knowledge from disparate disciplines such as biology, geology, oceanography, hydrology, chemistry and engineering. A plenary presentation of the project was invited to the December 2004 NSF-, NASA-, NBII-sponsored Workshop on Biodiversity and Ecosystem Informatics (“Eco-Informatics & Decision Making: Defining Research Objectives for Digital Government for Ecology”), as an example of a successful Digital Government effort (Olympia, WA, http://www.evergreen.edu/bdei/). Renewal of support is pending.

Within the same time frame, Wright completed the related project: ACI-0081487; $487,555, 9/1/00-2/28/05. ITR: Computational Environment Infrastructure with Applications to Mid Ocean Ridge Research: The "Virtual Research Vessel" Prototype, with J. Cuny, D. Toomey (University of Oregon), and J. Cushing (Evergreen State College).

Publications supported by the above grants are cited at the end of the References section of this proposal.