AC 2011-1833: THE CREATION OF TOOLS FOR ASSESSING ETHICAL AWARENESS IN DIVERSE MULTI-DISCIPLINARY PROGRAMS

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The Creation of Tools for Assessing Ethical Awareness in Diverse Multi-Disciplinary Programs

Introduction

Although an attention to ethics has long been part of the engineering profession—all of the core engineering societies have codes of ethics governing their own disciplines—the changes in academic accreditation standards in recent years have reified the challenge engineering educators face of identifying best practices for teaching and assessing ethical awareness. It has become necessary to adapt engineering curricula to meet the needs of what is quickly becoming a more socially-sophisticated profession, but curricula can be slow to change. It has been limited by the paucity of reliable tools designed specifically to assess ethical awareness. Engineering educators, then, must rise to the challenge of developing methods of ethics assessment in their classrooms, a challenge of primary importance if we are to meet the diverse needs of the engineers of the future. This paper describes research done to meet this challenge.

Four institutions with cross-disciplinary design programs have collaborated on the development of curricular materials and assessment tools that can be applied to undergraduate design programs. Our project began with the belief that with instruments for ethics assessment available, existing tools could be implemented or easily adapted to our needs. What became apparent is that the existing assessment instruments were not well-tailored to the unique qualities of engineering design programs. The Defining Issues Test (DIT and DIT2), for example, is perhaps the most commonly used measure of moral reasoning, but it does not measure moral reasoning as it is done within an engineering context.

One part of our project has been to develop a way to measure first the degree to which individual students are able recognize the parts of their design experience that carry ethical significance, and second the degree to which they are able to focus on the social factors that will lead to the most ethically-justifiable resolutions to the ethical uncertainty. The second part of our project has been to assess the ethical climate present in multi-disciplinary teams and to track the change in this climate over a period of time. Our focus on assessment is intended to help us establish a baseline understanding of our student's skills in ethical reasoning and the effects these have on team climate. Our assessment also will inform the creation of teaching materials and the educational interventions needed to help students develop and apply skills in ethical reasoning.

In the following we will describe the development process of three assessment instruments and several of the important lessons we learned through our research and development. The first instrument is a measure of ethical sensitivity and moral decision making skills. It is centered on real-world examples of ethical dilemmas and uncertainties in engineering. The method is modeled on validated instruments designed for other contexts and on major theories in moral development. The second instrument is a team ethical-climate measure we adapted from one validated in business contexts. This measure asks students to self-report their perceptions of the ethical behavior of their teammates. The third instrument is a taxonomy of ethical comprehension that can be used as a rubric for assessing ethical reflection essays. Our goal for the first two measures is to demonstrate both reliability and validity by utilizing accepted psychometric strategies. Our goal for the third is to demonstrate qualitative validity.

Overview and Motivation for Project

Education in STEM disciplines, such as engineering, has sought to incorporate the challenges introduced as engineering becomes an increasingly global profession. Interaction with more of the world's peoples and cultures introduces more social and ethical complexity to the profession[1] and raises the importance of practicing engineers becoming capable ethical-decision makers and positive contributors to ethical team climates. Though engineers have often effectively incorporated codes of ethics into the practice, these codes typically focus only on common professional conventions and on establishing the standards of professionalism. While they do much to set the tone for proper professional behavior, codes of ethics do not typically provide the specific guidance needed for today's (and tomorrow's) engineers to make ethically-justifiable decisions consistently in the culturally- and ethically-complex environments in which they will be working.

For example, though many professional codes of ethics compel engineers to hold paramount the safety of the public[2], we still might ask "to which public does that apply?" or "to what degree?" of "what qualifies as a valid exception?" Often engineers play multiple roles on the job—such as designer on the one hand, and manager on the other—and juggle competing professional interests. In such cases engineering codes of ethics may not go far enough and engineers themselves must possess personal skills in ethical reasoning in order to more fully address the complex ethical demands of their professional environment.

As engineering educators, we are responsible for helping to develop these skills in our students so they might transfer them into practice in the profession. It is our responsibility to help equip our students to be sensitive to the ethical complexities and the social contexts of their work. Students must be able to recognize the subtleties of social issues not only within their design work, but also within their own teams. Engineering is often a team-based profession and professional engineers must be equipped to contribute positively to a well-functioning and ethical work climate. How well an engineer contributes to the ethical climate of the team is as important a skill as that engineer's ability to make ethical decisions individually. As educators, then, we must have tools to measure both of these skill sets in pre-professional engineers. Proper measurement allows educators to design appropriate educational interventions and to track the growth of students as they learn. Measurement data also would allow for further research into what effects, if any, individual ethical reasoning skills might have on a team's ethical climate, or vice versa. Past research has suggested a direct impact of team ethical climate on individual ethical reason and perhaps also the reverse[3].

While several measures have previously been designed to assess general moral development, such as the Defining Issues Test (DIT)[4], all are intended to address ethical situations in general, rather than the peculiarities of ethical situations in STEM disciplines such as engineering. To date, no tool or practice has been developed and made available to capture the range of ethical work actually done in engineering. Researchers at Georgia Tech have developed the Engineering and Science Issues Test, but have not completed validation for engineering contexts. Similarly, there are a number of tools for measuring team ethical climate within professions[5-8]. The ethical climate assessment developed by Victor and Cullen[9] has been widely used and is well validated, but it, like many of the other measures, is designed for the business environment and does not translate directly to the engineering context.

Our ultimate goal as educators is to develop our students' ethical reasoning skills and equip them to guide themselves through the complexities of today's global, team-based engineering profession. As a significant step in achieving that goal, our project has aimed to 1) develop instruments to measure individual ethical reasoning and team ethical climate, 2) track the growth of these constructs in student populations, and 3) identify methods for developing educational interventions and teaching materials to help students develop these skills.

This project is a collaborative effort of four universities: Purdue University, Illinois Institute of Technology, Lehigh University, and Michigan Tech, and is funded by an NSF CCLI Phase 2 grant.

Collaborating University Programs

The four university partners in this project share many key similarities: all have undergraduate engineering programs with multidisciplinary teams, all support 25-40 teams per semester, all have learning activities related to engineering ethics and include ethics as part of their learning objectives for their design experiences. Each program, however, also has distinct features, as described below.

EPICS, a program in Purdue's College of Engineering, offers an innovative service-learning approach to teaching design where multidisciplinary teams of students partner with local community organizations to identify, design, build, and deliver solutions to meet the community's needs[10,11]. The goal of EPICS is to meet a critical educational need by providing hands-on engineering and technical design opportunities to a broad group of students, especially females and underrepresented minorities. The program also meets vital needs within the communities it serves by providing not-for-profit organizations—such as community service agencies, schools, museums, and local government offices—the resources they often need but cannot access. Each team is constituted for several years, from initial project definition through final deployment, allowing for projects of significant design complexity and high potential impact in the community. The designs produced by the EPICS teams address compelling issues in the local community that often have potential applications in other communities through dissemination or commercialization. The success of the EPICS program motivated the NSF to fund dissemination of EPICS to a consortium of institutions with similar interests. Currently, 21 schools are part of the EPICS University Consortium. More recently, EPICS has been adapted to a high school format that is being used in schools in seven states and by IEEE abroad. These networks will provide built-in dissemination vehicles for the results of the project.

The Illinois Institute of Technology (IIT) IPRO (Interprofessional Projects Program) has the broadest scope of projects of the four collaborating institutions, covering service learning, entrepreneurship, process improvement, and product/venture development. Every undergraduate student at IIT is required to participate in two IPRO projects as part of their General Education requirements. Students select projects, though some projects now require an application and approval process. IIT project teams are composed primarily of junior & senior undergraduate students across a range of majors (engineering, computer science, architecture, sciences, business, psychology, social sciences and humanities). During the fall semester of 2007, over 375 students participated in 37 multidisciplinary teams (each with a minimum of three majors represented). IIT is a private university in urban Chicago, with roughly 2,300 undergraduate and 4,500 graduate students, with 18% minority and a substantial [34%+] international student body. IPRO was initiated in 1995 with NSF funding.

Lehigh University has the Integrated Product Development (IPD) program within the Rossin College of Engineering and Applied Science. Lehigh is a private university located in Bethlehem, PA, with 4,600 undergraduate students and 2,000 graduate students. The IPD program was founded in 1994. It provides juniors, seniors and graduate students the opportunity to work in interdisciplinary teams with industrial sponsors to design, fabricate and produce new products for a global economy. At the undergraduate level, IPD draws students enrolled in Bio-Engineering, Mechanical Engineering and Mechanics, Material Science Engineering, Design Arts, and various business majors. About 150 students are distributed on 25 teams per semester with projects from industry sponsors, local entrepreneurial startups and student startups. The IPD team has been active with the ASEE and USASBE as well as several entrepreneurship-oriented foundations such as the NCIIA, Kern Family Foundation and Kauffman Foundation.

Michigan Technological University has the Enterprise Program, initiated in 1998 with funding from NSF to create an undergraduate curriculum that incorporates active and discovery-based learning. Michigan Tech is a public university, located in Houghton, MI, with 6,500 students, of whom 3,600 are in the college of engineering. The Enterprise Program recruits students from second year through seniors to participate in teams that operate like a company to solve real-world problems by performing testing and analysis, making recommendations, developing projects, providing services, meeting budgets and managing multiple projects. The Enterprise Program has grown to include 25 different teams, with 700 students participating, and representation from 25 different disciplines.

Differences in Learning Outcomes and Objectives

While these four programs share the fundamental characteristics of being multi-disciplinary team-based design courses, the diversity across the institutions also represents the richness of cultures found within engineering. Throughout our research, this richness constantly and significantly informed the path of development and led to a deeper understanding of both the complexity and the importance of teaching ethics in engineering. An important lesson learned is that while each program refers to "ethics" as one of their program objectives, the term "ethics" has multiple interpretations. Ethical awareness, for example, might mean having an awareness of the existence of professional ethical codes or to the ability to identify the existence of an ethical issue within engineering work.

We also noted that students in service-learning programs had a greater ethical responsibility. We have said previously that since service learning programs are by definition centered on direct interaction with the community—meaning the point at which students have direct contact with stakeholders in the community comes sooner than it would otherwise—we believe the development of useable, practical ethical skills must come sooner, too[12].

Service-learning engineering programs are responsible for preparing their students to be proper moral agents. This means taking them beyond the codes of ethics followed by their disciplines. It means helping them learn the skills of identifying circumstances of questionable ethical value, circumstances where codes of ethics might lack sufficient detail to function as a proper guide. In such cases engineers will need to have personal skills in ethical reasoning to be able to assess the situation they find themselves in, to consider what justifiable alternative solutions are available, to decide on the best course of action, given the situation, and to be able to justify that action afterward as the best among other choices. With this understanding as a starting point, our research began with developing an understanding of the types of ethical reasoning typically demanded by the engineering profession. This understanding informed the development of the Ethical Reasoning Instrument (ERI), a primary output of our research.

Individual Ethical Decision Making and the Development of the ERI

When engineering students work in diverse, heterogeneous teams employed on projects for human users, they will be asked to take into consideration the unique requirements dictated by the social contexts of their stakeholders. Their designs, and their methods of design, must be morally responsible relevant to this context, and the individual engineers should be able to give reasoned explanations for why they make the ethical decisions they do. In practice, this means students must be active moral agents who are able to analyze complex social phenomena, reduce a glut of information to only the pertinent items, and engage in a process of ethical reasoning that produces a justifiable course of action. Of course, all of this requires that students have skills in ethical reasoning and have knowledge that such reasoning is required of an engineer in the profession.

Recent research indicates that students are most likely to advance in their ethical reasoning skills primarily as a result of formal education[3]. Evidence indicates that for a student to be able to solve the complex problems encountered in today's engineering tasks, it is not sufficient to simply "learn the rules," but rather engage in experiences that allow them to practice ethical reasoning skills. Engineering educators are now well aware of "the important relationship between ethics and engineering design and the value of integrating the two within the curriculum"[13]. But the pace of curriculum development can be slow, and to date there are few resources available to help develop the appropriate curriculum and assessment tools. A goal of our study has been to develop the assessment instruments needed to get a better understanding of how students engage in individual ethical reasoning so we might in the future design better educational interventions to help students develop this skills.

Research and measurement of individual ethical reasoning has been developing in the last two decades. Since the appearance of the Defining Issues Test (DIT) from the Center for the Study of Ethical Development at the University of Minnesota, researchers have had a reliable tool to measure individual moral reasoning. The DIT is based on the landmark work in developmental psychology by Lawrence Kohlberg and works by identifying the stage at which a person is able to engage in moral reasoning in relation to Kohlberg's hierarchical model. And while the Kohlbergian model on which the DIT is based is not without its critics[14], many recent studies of individual moral reasoning have employed the tool[15-18]. The DIT has proven its effectiveness in measuring general moral reasoning, but it has not been established as an effective tool in measuring reasoning within a professional context, a decidedly different social context than everyday life, characterized by a more limited and more specific set of behaviors which are considered right and wrong—behaviors often articulated in codes of ethics. The studies mentioned above, and others like them, use the DIT to measure groups of people organized by their professions (i.e. IT professionals[15,16], medical laboratory professionals[17], and university housing professionals[18]) or they use it to establish a baseline description of individual's ethical reasoning abilities in order to look for correlations with other behaviors or to help validate results from other instruments[19]. They do not use the DIT as a measure of moral reasoning in an engineering context.

Our own preliminary research showed that generalized, non-engineering-specific ethical dilemmas, such as those encountered in the DIT are not seen as the same types of issues relevant to professional engineers. A student might claim, for example, that the issue of whether a man should steal much needed medicine to save his wife's life is conceptually different from considering whether to steal while on the job. The difference, the student might point out, is that engineers already work under a certain code of behavior that determines what is and what is not permissible. For example, we found that we could effectively teach our students the particulars of common hypothetical examples such as the "Trolley Problem," but later, when we asked them to apply their knowledge by identifying the ethical issues within their own project work, we found a disconnect. They were generally unable to apply the knowledge learned in abstracted examples to their own project work. They also seemed to require additional knowledge in order to engage in proper ethical decision making.

From this experience, we knew that we had to take our assessment instrument a step further than the DIT—since the DIT does not use engineering-specific examples—and ground the instrument in an engineering context. Any ethical reasoning in the professional context must first begin with consideration of what the relevant code of ethics recommends, and then ask whether this behavior is something that should be acted on, given the specific circumstance and the ethical principles motivating the engineer. This makes it difficult to use the DIT as a valid way of measuring how students engage in ethical reasoning in their unique professional contexts, contexts complicated by the inclusion of their own codes, their own rules, and their own norms of professional conduct.

To address this need we have begun work on developing a measurement instrument, the Ethical Reasoning Instrument (ERI), based on the successful structure of the DIT but tailored to the specific context of ethics within the engineering profession. It is designed to follow the successful approach of the DIT of tying into Kohlberg's stages of moral development. The instrument features short scenarios which present students with ethical dilemmas, then asks them to rate and rank a series of statements representing the types of factors students would weigh when thinking about the dilemmas. The scenarios are adapted from actual student projects and use engineering contexts such as issues of safety, design standards, and constraints of cultural norms. Analysis of the way students rate and rank the statements will indicate where they fall in Kohlberg's model of moral development. The ERI is intended to be used on a pre- and post-semester basis to measure the growth in student's skills after educational interventions.

Our method was to develop short scenarios which present students with ethical dilemmas. The scenarios are adapted from actual projects worked on by EPICS teams and are altered for anonymity and generalizability in order to maximize the students' likelihood of being able to transfer their decision-making abilities demonstrated on the assessment instrument to their own project work. Each scenario in the ERI asks students to choose an answer to the ethical dilemma, usually in terms of yes or no, rather than identifying a specific solution. This is to ensure they think through the dilemma enough that they can actually choose how to act. Students then rate 12 factors on a 5-point Lickert scale in terms of their importance in their decision making, then decide which four factors are the most important. These factors are mapped to the stages of our theoretical framework—Kohlberg's model of moral development—so as the students tell us which factors they think are most important to them, they also tell us the level at which they reasoning morally.

Team Ethical Climate

Team-level ethical influences can be evaluated by looking at the team's ethical climate, which is defined as a type of work climate that reflects the organizational procedures, policies, and practices with moral consequences[20]. Ethical climate manages the organization's norms and standards of practice for ethical behavior by influencing the shared perceptions of the individuals in the organization[21]. Ethical climate sets the tone for how individuals in a group perceive ethical issues and act on them[22].

Research suggests a reciprocal relationship between the ethical climate and individual moral behavior, thus examining one without the other provides insufficient understanding of ethical decision making. According to VanSandt[23], "not only is an individual's overt behavior a culmination of a series of cognitive and physical processes, but a plethora of factors in the social environment also influences the individual." Kohlberg also recognized that the group climate was a significant factor in the ethical decision making of the individuals with the group [23]. Thus when considering individual ethical reasoning within an engineering context, where the typical work context is the team, an understanding of the team ethical climate is necessary.

It is also important to consider the influence of the team ethical climate when investigating the impact of educational experiences. Although evidence indicates that people are likely to advance in their moral reasoning skills primarily as a result of formal education, training and development as well as organizational change, specialists note that interventions leveled at individual change may have short-term success but require similar training of the entire team or other organizational unit to be sustainable[23].

In addition, ethical climate in organizations has been found to influence organizational commitment, job satisfaction, work satisfaction, and observed ethical behaviors [20, 21, 24, 25]. We suggest that these outcomes can be observed in undergraduate teams through variables such as satisfaction with the course experience, satisfaction with the team, commitment to the team and its goals, and team behaviors. These outcomes would provide convergent measures for validity analyses.

In order to empirically examine team level ethics (and ultimately develop a measure), we turned to team attitudes literature, where we researched the concept of climate, which is defined as employees' shared perceptions of their organization's social environment that are manifested through thoughts, feelings, and behaviors[26]. Climate is measured for attitudes on some variable (e.g. climate for safety). Ethical climate is defined as a type of work climate that reflects the organizational procedures, policies, and practices that have moral consequences[20]. Ethical climate manages the organization's norms and standards for ethical behavior by influencing the shared perceptions of the individuals[21].

Ethical climate has been examined in business settings, but it has been neglected in the education research. In our search for adequate measures, the most promising initial measure was the Ethical Climate Questionnaire (ECQ[9]), a well-established survey used in businesses[27]. We were interested in making the ECQ relevant to undergraduate project teams, so we adapted the test and administered it to a group of undergraduate students in multidisciplinary teams. We kept the items that participants stated were relevant to their team experiences. After this initial work, we piloted the ECQ for education with excellent results. The dimensions of the original test were reflected in the dimensions found in the adapted version. The final 20-item survey was distributed to participants. Participants responded on a six-point Likert-type scale ranging from "totally disagree" to "totally agree." The complete measure had a reliability estimate of $\alpha = .87$, with subscales of laws and professional codes ($\alpha = .86$), institutional rules ($\alpha = .85$), instrumental ($\alpha = .79$), benefit to the team ($\alpha = .76$), and independence ($\alpha = .65$)[28].

The ECQ was administered at three of the NSF project sites in spring 2010. The results of the survey were different among the data collections. ECQ results at site 1 and site 2 provided results that were in line with past ethical climate research and our pilot data. However, site 3 produced dramatically different results. The teams partitioned ethical decisions in terms of other focus (professional laws and codes, institutional rules, and caring) and self-focus (independence and instrumentality). The overall reliability for this shortened version was $\alpha = .76$, with subscales of other-focus ($\alpha = .87$) and self-focus ($\alpha = .79$). The other-focus factors are externally based, focusing on the best interests of society. The self-focused items reflect the individual's perspective. One acts ethically in order to benefit the individual. Also, the individual rules are more important than others.

The dimensionality of the 14 items from the Ethical Climate Questionnaire for Cross-disciplinary Teams was analyzed using a principle components factor analysis. Three criteria were used to determine the number of factors to rotate: the a priori hypothesis that there are five unique dimensions, the scree test, and the interpretability of the factor solution. The scree plot and factor solution indicated that there are five components. The factor correlations were low, so orthogonal rotation was appropriate. Orthogonal rotation assumes that the factors are uncorrelated. This method also emphasizes the interpretability of the factors, making the data easy to interpret. Based on this reasoning, five components were rotated using a Direct Oblimin rotation procedure. The rotated solution, as shown in Appendix 2, yielded two interpretable factors. The first factor accounted for 32.63% of the item variance. The second factor accounted for 20.20% of the item variance.

There are a few potential reasons for these different results. It is possible that the different results at each institution reflect the level of complexity with which students think about ethics. It is also an artifact of contextual factors. At the site where teams thought of climate in terms of other and self, the students were given the ECQ in a packet along with seven other team surveys. At the sites where the ECQ had five dimensions, only 2 surveys were administered in a packet.

In light of these differences in results, further testing is needed to determine the validity of the ECQ for undergraduate research teams. IIT will continue to use the ECQ in spring 2011. See Appendix 3 for a sample. Additionally, we will employ a second measure. The Ethical Climate Instrument (ECI)[29]. Arnaud developed the ECI as an improvement on the work of Victor and Cullen, simplifying the dimensionality and re-emphasizing the basis in Kohlbergian reasoning. The author has provided initial evidence for the reliability and validity of the ECI in business settings, but it is unexplored in education. We intend to adapt the measure for education. We will find convergent validity evidence by administering both the ECI and ECQ to a group of students in project teams.

Ethical Taxonomy for Evaluating Reflections – Developing the DTEC
Our research team was also interested in developing a qualitative, easy to use measure of ethical comprehension. The researchers at each project site noticed that students had difficulties identifying ethical issues in their project work. However, this anecdotal evidence was not enough. We needed a formal, standardized way of determining how well the students understood the ethical complexities of their work. After it became apparent that no model classifying ethical comprehension currently exists, the team decided to create its own.

There are a few advantages to using standardized measures of ethics. First, they make it easy for faculty or administrators who are not formally trained in ethics to evaluate students' ethical awareness. Ethics is a notoriously difficult concept to evaluate, and this is especially so for individuals without a background in ethics. Second, rubrics allow the evaluator to grade the work of several individuals with the same set of standards. Without a formalized rubric or other measure, the evaluator may grade each piece differently, which could lead to biased results. Standardized measures such as rubrics also maximize efficiency in grading.

The taxonomy is modeled after a well-accepted learning taxonomy[30] and is designed to identify the current level of ethical comprehension for individuals, but our population of interest was undergraduates working in long-term projects. There are multiple areas to consider in team ethics. Students should be able to consider how their actions affect clients, but there are also team-level ethics, research ethics, codes and standards for each profession, etc. The ethical taxonomy can be used to identify deficiencies in individual student understanding of ethics in their projects. Likewise, it can be used to track progress in their level of comprehension or learning throughout the course of their time in the projects and to evaluate the effectiveness of educational interventions meant to improve ethical awareness.

The Developmental Taxonomy of Ethical Comprehension (DTEC) is intended to measure the level of ethical awareness an individual has at any given time. However, the instrument is not designed to be used alone. Rather, it should be supplemented with an additional measure that provides some evidence of reasoning, such as the ERI. In experimental design, it can be used as a pre-measure as well as a post-measure. Differences in level of ethical comprehension obtained can be used as evidence of learning. Therefore, it is intended to measure construct validity.

The taxonomy began development in spring 2010. It went through initial content validation in June 2010. We validated the taxonomy by giving it to a set of professional ethics researchers at the Center for the Study of Ethics in the Professions at the Illinois Institute of Technology. They provided detailed written feedback on the taxonomy, and we incorporated these changes into the subsequent version of the taxonomy. The initial taxonomy was also presented to the entire four school project team for feedback. The taxonomy will be revised and given to a focus group of educators, undergraduate students, and ethicists to critique. The taxonomy will be revised again. This will provide initial evidence of content validity. The taxonomy will be distributed again in spring 2011.

Future work and directions

We teach our students that they have to go through stages of team development before they can work productively together. We as faculty too often want to skip those stages. Our team of faculty, staff and students from the four partner universities has developed into a team and are committed to continue working together as we develop more effective ways to teach and assess ethical development at the team and individual levels. While the learning objectives vary across the program, there is a common desire to improve the ethical development of our students before they graduate and leave our programs.

We are continuing to develop new instruments: one to assess individual ethical reasoning (ERI), a second to assess the team ethical climate (TECS), and a third to analyze ethics reflections (DTEC). As the current CCLI grant is coming to an end this year, the team is seeking resources to support the continued development of the instruments. The intent is to continue to refine both instruments, performing validity and reliability analyses and revising the instruments and distributing them to all four programs. Interviews, focus groups and observations will be part of the validation process for both instruments as well as comparing results with existing instruments for selected populations of students. The expectation is to have valid and reliable instruments to distribute. These will allow for comparison across programs and populations that would enhance our ability to promote the development of ethical reasoning skills in our graduates.

This work is not intended for the sole use of the four participating schools and the authors welcome collaborators who share an interest in the development of ethical reasoning. Please contact the authors for more information.

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Appendix 1

Example Ethical Reasoning Instrument (ERI) scenario:

Your team has received financial backing to build a flood-control system for a local elementary school. After heavy rainfall the nearby duck pond overflows and floods much of the teacher's parking lot. Your grant proposal outlines your team's design for a drain system that would redirect rainwater away from the parking lot and into the town's underground storm drain system. Just prior to beginning construction you see that an unrelated city roads project has created a berm of hard-packed soil close enough to the lake to keep its overflow from flooding the parking lot. Your design is no longer needed. But this new construction has introduced a new problem. The berm is large and cuts down on visibility in the parking lot. Parents and bus drivers report finding it more difficult to safely enter and exit the parking lot so the school asks your team to work on a traffic management system to increase driver safety. Since the new plan will be roughly the same cost as the original design, your team members suggest you use the original grant money for the new project. The grant award does not say that it cannot be used for another project, but it clearly was intended to fund the flood-control system, not the traffic management.

Should you spend the grant money on the new project?
____ Yes ____ No ____ Can't decide

Please rate the twelve statements below from 1 (not very important) to 5 (very important) on how important each is in making a decision about what to do in the scenario.

_____ 1. Everyone will get what they want if you build the new project.
_____ 2. You said you would use the grant money for the original flood-control project.
_____ 3. The grant language does not specify penalties for using the money for other projects.
_____ 4. What the grant givers don't know can't hurt them.
_____ 5. The school wants you to work on the traffic management project.
_____ 6. Traffic management is a skill you would like to learn.
_____ 7. Your grant proposal mentioned only the flood-control system, not the traffic-management system.
_____ 8. Traffic management design skills might get you a job when you graduate.
_____ 9. Grants are usually given for a specific use.
_____ 10. No one and nothing will be harmed by using the grant money on the new project.
_____ 11. Your team leader encourages you to work on the new project.
_____ 12. What if everyone spent grant money on different projects?

Please rank the top four most important statements.

_____ Most important statement
_____ Second most important statement
_____ Third most important statement
_____ Fourth most important statement

Appendix 2

*Factor loadings and commonalities based on a principle components analysis with Oblimin rotation for 14 items from the adapted version of the Ethical Climate Questionnaire (ECQ) (*N *= 177)*

	Dimensions	
	Other	Self
People are expected to comply with the law or rules and professional standards over and above other considerations.	**.72**	-.09
Our major concern is always what is best for the other person.	**.76**	-.06
People are expected to strictly follow the team charter or professional standards.	**.78**	-.03
IPRO's rules and procedures are important to follow.	**.76**	.06
Everyone is expected to stick by IPRO rules and procedures.	**.77**	.01
The law or ethical code of my profession is a major consideration.	**.58**	-.14
The most important concern is the good of all the people in the team.	**.65**	.15
Our major consideration is what is best for everyone in the team.	**.65**	.15
It is expected that you will always do what is right for the end users and possible consumers and public.	**.70**	-.11
People are out mostly for themselves.	-.04	**.84**
There is no room for one's own morals or ethics.	.08	**.75**
Each person decides for oneself what is right and wrong.	-.03	**.74**
People protect their own interest above other considerations.	-.11	**.84**
People are guided by their own ethical principles.	.03	**.47**

Note. Factor loading > .40 are in boldface.

Appendix 3

Ethical Climate Questionnaire (ECQ) Revised Version
(adapted from Victor & Cullen, 1988)

Directions: Read each question and select the answer that corresponds to the extent to which you agree with the following statements about your current IPRO team.

Strongly Disagree	Disagree	Somewhat Disagree	Somewhat Agree	Agree	Strongly Agree
1	**2**	**3**	**4**	**5**	**6**

In my current IPRO team:

People are out mostly for themselves.	1	2	3	4	5	6
People are expected to follow their own personal and moral beliefs.	1	2	3	4	5	6
People are expected to do anything to further the team's interests.	1	2	3	4	5	6
People look out for each other's good.	1	2	3	4	5	6
There is no room for one's own morals or ethics.	1	2	3	4	5	6
It is very important to follow strictly IPRO's rules and procedures.	1	2	3	4	5	6
Each person decides for oneself what is right and wrong.	1	2	3	4	5	6
People protect their own interest above other considerations.	1	2	3	4	5	6
The most important concern is the good of all the people in the team.	1	2	3	4	5	6
The first consideration is whether a decision violates any laws or rules.	1	2	3	4	5	6
People are expected to comply with the law or rules and professional standards over and above other considerations.	1	2	3	4	5	6
Everyone is expected to stick by IPRO rules and procedures.	1	2	3	4	5	6
Our major concern is always what is best for the other person.	1	2	3	4	5	6
People are expected to strictly follow the team charter or professional standards.	1	2	3	4	5	6
Our major consideration is what is best for everyone in the team.	1	2	3	4	5	6
People are guided by their own ethical principles.	1	2	3	4	5	6
Successful people strictly obey the IPRO team policies.	1	2	3	4	5	6
The law or ethical code of my profession is a major consideration.	1	2	3	4	5	6
Each person is expected, above all, to work efficiently.	1	2	3	4	5	6
It is expected that you will always do what is right for the end users and possible consumers and public.	1	2	3	4	5	6