

CERIAS Tech Report 2007-89

Ethical attributes in computing and computing education: An exploratory study

by Melissa Dark, Nathan Harter, Gram Ludlow and Courtney Falk

Center for Education and Research

Information Assurance and Security

Purdue University, West Lafayette, IN 47907-2086

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Melissa Dark
Purdue University
401 N. Grant Street
West Lafayette, IN 47907-2021
765-494-0486 fax
dark@purdue.edu

Nathan Harter
Purdue University
545 South CR 200 West
Greensburg, IN 47240
812-663-6478 fax
nharter@purdue.edu

Gram Ludlow
Purdue University
656 Oval Drive
West Lafayette, IN 47907-2086
765-496-3181 fax
gludlow@purdue.edu

Courtney Falk
Purdue University
656 Oval Drive
West Lafayette, IN 47907-2086
765-496-3181 fax
court@cerias.purdue.edu

Keywords: computing, education, ethics, moral development

I. Introduction

There is an ongoing concern about workplace ethics. Many voices say that our educational system ought to do something about it, but they do not agree about how to do this.

By the time students reach post-secondary education, they will have already developed a general moral sense. The concern is whether their moral sense is sufficient for ethical situations in the workplace. If not, post-secondary education is expected to close the gap. In order to do this, educators need information about what is missing.¹ Educators can set clear, work-related objectives and use classroom activities to reach those objectives based on an identification of these gaps. One of the more effective methods for teaching ethics at the post-secondary level is the ethical dilemma, a predicament of the sort students might see upon graduation (e.g. Dick, 1994; Gotterbarn, 1998, citing Dunfee, 1986; cf. Floridi, 1998). The use of ethical dilemmas for ethics education is not new. However, current instructional resources in ethics education usually take an issues based approach. By this we mean that the ethical dilemmas presented focus on competing and sometimes conflicting social issues, such as privacy. From the issues based perspective, students engage in activities such as: defining concepts of privacy, describing how notions of privacy have evolved and relate this to the growth of the Internet, describing privacy protection laws, rules and guidelines, giving examples of laws that limit privacy and so on.

Occasionally, the pedagogical approach taken extends beyond the issue to include predominant ethical theory. These instructional resources usually include a discussion of major ethical theories, e.g., deontological ethics, utilitarian ethics, etc. In some cases, the ethical theories are used to provide a framework for reasoning about right and wrong with regard to the ethical issue. Let us return to our example on privacy. Using this approach, students engage in activities such as: discussing who should have access to personal information and why,

discussing the consequences of privacy breaches to various stakeholders, and identifying conflicts of interest issues as they pertain to privacy. Activities for using ethical theory as a framework for exploring ethical issues might include: using theory based reasoning to make judgments about what ought to be done in a situation, analyzing how differing ethical theories implicate notions of right and wrong regarding issues of privacy, ownership, etc.

While both approaches (issues only and issues framed by ethical theory) are worthy, we contend that ethics education needs to also incorporate a personal moral development component. Moral development describes the stages and transitions that humans experience as they develop morally, as they develop their own *personal* beliefs and behaviors about right and wrong. The focus of study in moral development is the individual. Using this approach, students extend their deliberations about privacy to include activities such as: developing the capacity for critical examination of one's own assumptions and tendencies, and evaluating themselves from the perspective of an outsider, asking the questions an outsider is likely to ask about the meaning and function of their craft.

In order to take a moral development approach to designing dilemmas for use in the post-secondary classroom, educators must first become familiar with the outside perspective. To do this, they must periodically consult computing practitioners in the workplace and investigate beliefs about the ethical aspects of the craft, especially with regard to college students who are soon to enter the profession. It was toward that end the authors began this study.

II. Literature Review

In 1996, Kanungo and Mendonca stated “[T]here seems to be a consensus in contemporary North American society that there is at least an ethical malaise, if not a full-blown

ethical crisis....” (p. ix). Halberstam makes a similar observation: “Talk about ethics is everywhere. From all sides, we’re told that we’re morally confused and need to reestablish our values” (1993, p. xv). There is a widespread perception that ethics in our time has become problematic, especially in the workplace. Gini references three different surveys from 1985, 1987, and 1990, concluding that conventional wisdom considers “business ethics” to be an oxymoron (1998, p. 27f). Hunter begins his work on moral education with similar remarks, writing that this is “a time when the call to ‘renew values’ and to ‘restore character’ is especially loud, persistent, universal – not to mention urgent.” He continues, “The summons to restore character is felt ardently....” (2000, p. xiii). What is interesting to us in these calls to action, i.e., to restore character and rebuild values, is the focus on personal moral development.

The crisis in ethics, even if only a *perceived* crisis, inhibits the social capital on which prosperity is based, as Fukuyama goes to great lengths demonstrating in his 1995 book *Trust*. A crisis in ethics in society reduces trust in general, and the decline of trust in a profession increases the cost of doing business. Consequently, the community suffers in tangible ways from breakdowns in ethics. The community also suffers a crisis of legitimacy, as the grounds for trusting leaders and professionals erode, so that people question their privileges and authority. When trust decreases, people defer less and demand increasing scrutiny in the form of government regulation, audits, special prosecutors, investigative reporting, and all sorts of encumbrances on cooperation. In effect, they begin to wonder, “Why should I listen to you?”

Computing is no exception because it is also regarded as a profession (Johnson, 2001; Luegenbiehl, 1992). As such, “[c]omputer professionals have special powers and privileges by virtue of their skill and knowledge and the positions they hold in organizations” (2001, p. 59). A well-accepted characteristic of a profession that distinguishes it from an occupation is self-

regulation with regard to the long-term effects of actions on society. When a profession is perceived to be unwilling or unable to police itself, society tends to withdraw support for it. Thus, a profession's standing in the community suffers from any perceived lack of ethics. It is for this reason that practitioners have a stake in making sure that their colleagues live up to the highest standards when practicing the craft. An ethics crisis in the computing profession diminishes trust and throws its legitimacy into doubt.

What is to be done about this so-called crisis in ethics? Are we stuck? Many experts from Aristotle to Kohlberg held that an individual's ethics develop with time and experience. The ethical development of any given person is dynamic and ongoing, well into adulthood. Who, then, is responsible for this change?

Hunter states hyperbolically "that nearly everyone in America acknowledges the need for 'values education'" (2000, p. 3). Thus, "the call for moral education finds a large and receptive audience" (2000, p. 4). He continues: "We say to ourselves...we only need to educate our children better. The reasoning is not exceptional. The institutions that educate, schools not least among them, have self-consciously taken on this responsibility for generations" (2000, p. 9). Hunter concludes in this way: "In our own time the burden of moral education and character formation falls especially to the schools" (2000, p. 26). In short, Hunter expects educational institutions to undertake ethics training.

Kanungo and Mendonca concur and even go so far as to say that "schools ought to regard character formation as the core element of their mission" (1996, p. 5; see also p. ix). Slaughter has been cited in support of the proposition "that education is the *only* answer [*emphasis added*]" (Dick, 1994, p. 70, citing Slaughter, 1992). Winrich writes, "There is...increasing pressure from the employers of university graduates to include some consideration of ethics in the curriculum"

(1994, p. 121). As Rogers puts it: “Higher education needs ways of understanding, assessing and fostering adult moral growth” (2002, p. 325).

This pertains to the education of computing professionals. Pulliam reports that in 1994 the Computer Science Accrediting Board required some kind of education in “computer values and the impact of computers on society....” (1994, p. 80). Dick goes so far as to say that “curriculum review bodies regularly call for ethics to be a part of the formal curriculum...” (1994, p. 69; see generally Bynum, 2001, § 3.5).

While this topic has been discussed by university teachers of computer ethics since the late 1980s, little work has been done from the personal moral development perspective. It is toward this end that the authors sought to help instructors think about computing ethics from the perspective of personal moral development. We take the approach that programs such as computer science and information technology are arguably in a better position than philosophy departments to represent the computing culture and context to students by bringing into the classroom what practitioners expect from their graduates.

If there is an ethics gap then what is missing? This question needs to be asked before actually designing appropriate instruction for classroom use. The literature on ethics splits into two approaches.³ In his textbook on ethics, Waluchow refers to “dispositions” and “occurrences” (2003, p. 206f). A “disposition” pertains to the character of the person, something relatively permanent and representative of who they are. Kierkegaard “spoke of character as ‘engraved,’ deeply etched, graven, ‘changeable rarely and least of all in extreme situations’” (Hunter, 2000, p. 19). The classic word for this approach is “virtue”. Philosophers such as Aristotle, Aquinas, and more recently, Alasdair MacIntyre, all discuss theories of virtue ethics. An “occurrence”, on the other hand, has to do with a single event or episode, how a person

makes choices at any given moment. Theorists associated with this approach include Kant (based on a standard of duty), Bentham and Mill (based on a standard of maximizing utility), and in our time Donagan, Nozick, and Rawls (based on a standard of fairness).

Dispositions and virtues reflect what kind of person you are. From this approach a person might ask, “Are you a good person?” In contrast, occurrences are measured case-by-case as a process of making decisions. From this other approach a person might ask, “Did you make the right decision?” These two questions are similar, but not identical. The difference between them represents different approaches to professional ethics and therefore, different approaches to teaching professional ethics.

Many educators presently use the ACM code of ethics in their classrooms. The ACM code of ethics includes principles, rules, and guidelines. The *principles* are virtue oriented (e.g. act at all times with integrity), while the *rules* and *guidelines* pertain to occurrences. The distinction, in other words, is already embedded in the code.

Which approach will computing practitioners perceive to be lacking? When they describe an ethics gap, will they characterize it as a problem of disposition, for example that recent graduates are lazy, or of occurrence, for example that recent graduates rush too quickly in their work? The distinction would help educators identify which approach they will take in the classroom.

II. Methodology

This descriptive study investigated the following questions:

- A. What ethical attributes are most lacking in recent college graduates who become computing professionals?

B. Are these attributes more virtue based or decision making?

C. What ethics issues are graduates most uninformed about?

An interview guide and attribute list were developed and used to guide the inquiry. The attribute list consisted of randomly distributed attributes commonly associated with virtue or character on the one hand, and attributes commonly associated with conduct or decision-making on the other. The interview guide consisted of several questions that in composition addressed the three research questions listed above. The interviews were conducted by different researchers, the semi-structured interview guide was needed to ensure that the same basic lines of inquiry were pursued with each participant.

Purposeful sampling was used to obtain participants in two main groups 1) software and hardware manufacturers, and 2) organizations that rely heavily on software and hardware. Purposeful sampling in qualitative research focuses on relatively small samples “selected purposefully to permit inquiry into and understanding” (Patton, 2002, p. 46) in depth, which is distinctively different from sampling in quantitative research, wherein the goal is to generalize with confidence from the sample to the population it represents and therefore typically depends on larger samples.

Twenty-one practitioner participants were interviewed. The interviews were conducted in the spring and summer of 2004. Participants were interviewed over the telephone with interviews tape recorded and transcribed in full. Inductive analysis was used to discover patterns themes, and categories in the data. More specifically, content analysis was used to determine patterns and themes in the interviewees’ responses to the questions posed during the interview. During content analysis “open coding” methods (Strauss and Corbin, 1998 as cited in Patton, 2002) were used to identify themes and patterns in the early stages of data analysis. Once

themes and patterns were established, confirmatory analysis was used to test and affirm the authenticity and appropriateness of the inductive content analysis (Patton, 2002).

The authors used data source triangulation and analyst triangulation to reduce bias that can arise in single-method and single-observer studies. Data source triangulation was used to compare and cross-check the consistency of findings generated by different data collection methods within qualitative methods (Patton, 2002). Multiple analysts were used to ensure analyst triangulation during the review of findings (Patton, 2002). During data source triangulation, we checked the consistency of findings generated by different data collection methods, i.e., the attribute ranking instrument and the interviews. We analyzed the interview transcripts along with the attribute lists in order to identify areas of convergence. In addition, we analyzed the consistency of responses from each participant across the different questions within the interview. We also used multiple analysts to review findings in an effort to reduce the potential bias or error that could be introduced from one person doing all of the data collection and analysis.

III. Results

The results of this study are reported in two sections corresponding to the following questions: A) What is the gap in ethical attributes? B) What is the nature of the ethics gap in terms of virtue and decision making approaches?

A. What is the gap in ethical attributes?

To address the first question, we investigated 1) the attributes of computing professionals that were deemed most desirable by computing practitioners, 2) the attributes that were deemed

most lacking, and 3) perceptions regarding whether the ethics gap is growing, diminishing, or staying the same. The results are reported below in Table 1 and Table 2.

Table 1 below shows the attributes ranked from most to least desirable according to the percentage of respondents. Table 2 shows the attributes ranked as most to least lacking according to the percentage of respondents.

| | |
|--|--------|
| works well with others | 89.47% |
| honest | 78.95% |
| concerned with quality of work | 68.42% |
| displays professional behavior | 63.16% |
| dedicated to improving self | 63.16% |
| innovative | 57.89% |
| solid reasoning skills | 47.37% |
| disciplined | 36.84% |
| concerned with consequences of actions | 36.84% |
| responsible | 36.84% |
| open to new ideas | 31.58% |
| ambitious | 31.58% |
| creative | 31.58% |
| learns from mistakes | 31.58% |
| flexible | 31.58% |
| willing to take risks | 31.58% |
| organized | 26.32% |
| goal oriented | 21.05% |
| passionate | 21.05% |
| curious | 21.05% |
| persists on tasks | 21.05% |
| objective | 15.79% |
| confident | 10.53% |
| diligent | 10.53% |
| respectful | 10.53% |
| courageous | 10.53% |
| able to identify stakeholders | 5.26% |
| patient | 5.26% |
| just | 5.26% |
| logical | 5.26% |
| economical | 5.26% |
| tolerant | 0.00% |
| dutiful | 0.00% |
| intuitive | 0.00% |
| hopeful | 0.00% |
| prompt | 0.00% |

Table 1: Attributes desired

| | |
|--|--------|
| concerned with consequences of actions | 93.33% |
| organized | 66.67% |
| disciplined | 66.67% |
| displays professional behavior | 60.00% |
| persists on tasks | 60.00% |
| tolerant | 53.33% |
| able to identify stakeholders | 53.33% |
| responsible | 46.67% |
| objective | 40.00% |
| intuitive | 40.00% |
| solid reasoning skills | 40.00% |
| prompt | 40.00% |
| works well with others | 33.33% |
| respectful | 33.33% |
| concerned with quality of work | 33.33% |
| dedicated to improving self | 33.33% |
| dutiful | 26.67% |
| flexible | 26.67% |
| logical | 26.67% |
| willing to take risks | 26.67% |
| honest | 20.00% |
| creative | 20.00% |
| diligent | 20.00% |
| learns from mistakes | 20.00% |
| curious | 20.00% |
| hopeful | 20.00% |
| patient | 20.00% |
| goal oriented | 13.33% |
| passionate | 13.33% |
| confident | 13.33% |
| courageous | 13.33% |
| open to new ideas | 6.67% |
| innovative | 0.00% |
| ambitious | 0.00% |
| just | 0.00% |
| economical | 0.00% |

Table 2: Attributes lacking

We then used an index value to cross-reference the two parts of the completed attribute lists. The "index value" is meant to represent the relative importance of each trait based on the two factors: attribute desirability and perceived lack in recent college graduates. It was calculated by multiplying the two percentages for each attribute in decimal form and then multiplying by 100. For example, concerned with consequences of actions was 36.84% for desirability and 93.33% for lacking. This results in $(.3684 * .9333) * 100 = 34.38$. Using such a scale, the top ten traits stand out more against the rest, as shown in **Error! Reference source not found.**

| | | | |
|---|--------|-----------------------------------|-------|
| 1. displays professional behavior | 37.895 | 19. goal oriented | 2.807 |
| 2. concerned with consequences of actions | 34.386 | 20. passionate | 2.807 |
| 3. works well with others | 29.825 | 21. able to identify stakeholders | 2.807 |
| 4. disciplined | 24.561 | 22. open to new ideas | 2.105 |
| 5. concerned with quality of work | 22.807 | 23. diligent | 2.105 |
| 6. dedicated to improving self | 21.053 | 24. confident | 1.403 |
| 7. solid reasoning skills | 18.947 | 25. logical | 1.403 |
| 8. organized | 17.544 | 26. courageous | 1.403 |
| 9. responsible | 17.193 | 27. patient | 1.052 |
| 10. honest | 15.789 | 28. innovative | 0 |
| 11. persists on tasks | 12.632 | 29. tolerant | 0 |
| 12. flexible | 8.4211 | 30. ambitious | 0 |
| 13. willing to take risks | 8.4211 | 31. dutiful | 0 |
| 14. objective | 6.3158 | 32. intuitive | 0 |
| 15. creative | 6.3158 | 33. hopeful | 0 |
| 16. learns from mistakes | 6.3158 | 34. prompt | 0 |
| 17. curious | 4.2105 | 35. just | 0 |
| 18. respectful | 3.5088 | 36. economical | 0 |

Table 3: Attributes by index score

A discussion of each ethical attribute exceeds the scope of this paper. The authors focus on certain attributes as the most illuminating. “Concerned with consequences of actions”, “honest”, “works well with others”, and “displays professional behavior” were the attributes chosen. These attributes are especially interesting because they all seem to be inter-connected. All four of the attributes we will discuss heavily involve inter-relations among people.

1. Displays professional behavior. Displaying professional behavior was the highest scoring attribute based on index value and was also directly mentioned by about one fifth of the professionals interviewed. Two cited it directly, listing among the most important traits on an IT professional "high quality professional behavior" and "honorable behavior." However, because professional behavior covers a very large array of behaviors, many of the informants discussed aspects of professional behavior without naming it as such. One professional felt very strongly that "the professions are where people have to trust you to do the right thing" and trustworthiness was a key attribute to have. Another mentioned that they "need to have a good end-user perspective; they need to focus on the customer." Other potential aspects of professional behavior that were mentioned include respect, having a strong work ethic, being motivated, being reliable and dependable, and avoiding finger pointing.

2. Concerned with the consequences of actions. Being concerned with the consequences of one's actions was the second highest scoring attribute as well as a frequently mentioned trait with almost half of the individuals mentioning some aspect of it in their interview. Some participants were concerned about college graduates being uninformed of the consequences of their actions on others. One participant noted that they need a "basic knowledge that what [they] do will affect others." Another voiced that the need for this is motivated because "actions taken, not only affect them, but have the potential for dramatically affecting others." One professional put it this way, "It doesn't seem like they have a vested interest in what the consequences of their actions are. They take it lightly; they don't really understand the ramifications or the repercussions of a particular event or instance." Another used more general terms: "They're not making the connection between what affects society and what the end result of their work will be."

One senior supervisor called this desirable attitude “a very others-oriented mentality.” An alternative way this was said was that co-workers “need to have a good end-user perspective; they need to focus on the customer.” Another made a similar observation: “at the end of the day I need to understand the larger impacts of the things that I’m working on.... In many cases you have to have a sense of the world outside of the computing ecosystem.” Yet another said, “I can see when people get off line on a decision: it’s often that they didn’t consider the bigger picture.” Instead, commented a former military officer, “teach someone how to look at the overall picture and not be so narrow sighted at their job...care what other people have to do with the whole system.”

Another theme in the interviews is that recent college graduates make self-centered decisions. What is lacking, therefore, is a more selfless perspective or attitude. One informant called this a "me syndrome." He said, "college graduates tend to be more interested in themselves...." He repeatedly voiced a concern that college graduates have too much personal ambition and not enough interest in others. From another interview, a supervisor identified the same attitude in a generation "that I saw were very much in the ‘What's in it for me?’ attitude." She continued, "It's the whole attitude of ‘Why should I wait? I deserve this now. I'll just do whatever it takes to do it.'" The so-called "me syndrome" was not strictly selfishness, but was also attributed to apathy and ignorance. The “me syndrome” does not consider personal or professional repercussions of actions except for the immediate gains they may bring.

Informants also insisted that recent college graduates need to show greater concern for the consequences of their behavior to themselves. We asked our informants what some of the consequences might be to breaking ethics codes. The responses were vivid. They included progressive discipline, termination, legal liability, social stigma, and decertification.

3. Works well with others. The manner in which a professional interacts with other people interested several participants. For instance, an IT security and disaster recovery coordinator wants classroom teachers to show “how to work with other people in groups, in teams, in larger organizations.” A security architect mentioned “working within corporate structures.... Ethics is more a part of the employer-employee relationship.” This would include avoiding harassment and discrimination, offering bribes and accepting gifts, respecting the property of others, and so forth. Another person who works at a technology center talked about telecommuters keeping accurate time sheets. Yet another found that the firm’s ethics code pertained to “how you represent the company” to buyers and vendors. A director of university research said that “the individual needs to be able to work within a team.... They will be dealing with technical problems, but they are also dealing with interpersonal problems, because they are part of a team to get a project done.” In other words, computing has not removed the need for these basic interpersonal values.

4. Honest. Participants frequently mentioned honesty and the role of honesty in ethics and closely tied honesty to issues of integrity and trustworthiness. One participant noted that “honesty and integrity are umbrella attributes” from which ethical decisions stem. “You want to be honest and upfront...honest and trustworthy...honest and forthcoming,” said one person who emphasized that without honesty, a person loses credibility and trust. A director of business systems and operations said this: “First would be honesty on the job....” He referred to honesty and integrity as unwritten expectations. Another informant placed honesty at the top of the list, before dedication and open-mindedness. Another concurred: “In the area of writing programs...being honest and forthright with where the project is.... The first [attribute] would be to be honest on the job....” Someone else said, “I would have to say that, if I’m dealing with

somebody, I want to know that their word is worth something. That is the bottom line.” Two participants used almost exactly the same words:

- “[J]ust tell the truth as best you understand it, and search for it. Speak the truth always irrespective of the consequences....”
- “[J]ust tell the truth as best you understand it, and search for it. Always seek the truth.”

Another participant noted the relationship between honesty and professionalism when she said, “What the heck does it mean to be a professional? It’s not you’re really good at what you do. The things that become professions are where people trust you to do the right thing...ethics is doing the right thing when no one is watching.” In summary, practitioners seem to be looking for employees who are honest in and with themselves and also who are honest in their dealings with other people, other organizations, and within the profession as a whole. A lack of honesty was expressed as a betrayal and threat to the larger professional community.

B. What is the nature of the ethics gap in terms of virtue and decision making approaches?

Prior to sending the attribute list, we had coded each of the attributes, randomly distributing those attributes that we considered to be virtue based and those we considered to be decision based. Table 4 below shows the attributes by index score with the decision based attributes in bold.

| | | | |
|--|--------|--|-------|
| 1. displays professional behavior | 37.895 | 19. goal oriented | 2.807 |
| 2. concerned with consequences of actions | 34.386 | 20. passionate | 2.807 |
| 3. works well with others | 29.825 | 21. able to identify stakeholders | 2.807 |
| 4. disciplined | 24.561 | 22. open to new ideas | 2.105 |
| 5. concerned with quality of work | 22.807 | 23. diligent | 2.105 |
| 6. dedicated to improving self | 21.053 | 24. confident | 1.403 |
| 7. solid reasoning skills | 18.947 | 25. logical | 1.403 |
| 8. organized | 17.544 | 26. courageous | 1.403 |

| | | | |
|----------------------------------|--------|-----------------------|-------|
| 9. responsible | 17.193 | 27. patient | 1.052 |
| 10. honest | 15.789 | 28. innovative | 0 |
| 11. persists on tasks | 12.632 | 29. tolerant | 0 |
| 12. flexible | 8.4211 | 30. ambitious | 0 |
| 13. willing to take risks | 8.4211 | 31. dutiful | 0 |
| 14. objective | 6.3158 | 32. intuitive | 0 |
| 15. creative | 6.3158 | 33. hopeful | 0 |
| 16. learns from mistakes | 6.3158 | 34. prompt | 0 |
| 17. curious | 4.2105 | 35. just | 0 |
| 18. respectful | 3.5088 | 36. economical | 0 |

Table 4: Decision vs. virtue based ethics by index score

Error! Reference source not found. shows that of the top 10 attributes using the index score, 6 of the 10 are decision based. This suggests a slight emphasis on decision making skills over virtue based skills, which was also true when we looked only at those most desired (6 out of 10 most desired attributes were decision based) and most lacking (6 out of 10 most lacking were decision based). What stands out is that concern with the consequences of actions was, aside from honesty, the most discussed attribute among the interviews. Informants mentioned both virtue-based and decision-based approaches.

V. Implications for Teaching

For educators who want to extend their teaching of ethical issues to include a moral development perspective, we offer several suggestions for how to use the findings of this study. We begin with thoughts on teaching ethics from a decision-making versus virtue perspective. Teaching ethics from these two perspectives would be similar, though not identical. Decision-making would be taught as technique, offering a method for working through a process and giving students multiple opportunities to apply the method to a variety of situations until they become familiar with the it, if not proficient. A classic example would be utilitarianism, in which you calculate the amount of happiness your alternatives will bring about and choose the

one that maximizes happiness, according to a formula about the greatest good for the greatest number. The method itself does not specify the outcome.

It is possible to approach teaching virtue in the same way, but virtue itself is more than any single decision. Virtue pertains to a person's character. For this reason, teaching virtue becomes a process of building character – a more ambitious objective. Aristotle referred to it as becoming “habituated” – so that it more about who you are than what you do. It is not just a mental exercise. It is also less interested in outcomes in the external world. It is more about self-improvement or personal development.

Regardless of whether it is decision making or virtue ethics, in order for any learning to take place, one must first capture the attention of the student. This step includes arousing the curiosity of the students in an effort to motivate students to learn. Thought provoking questions, interesting stories and facts can pique students' interest in a topic. We suggest several ways to gain attention. First, students could be asked which ethical attributes they think are most desired by employers. The findings can then be compared to the findings of this study. Or educators can present the findings of this study and ask students to define what they think it means to display professional behavior or to be concerned with the consequences of actions. The teacher can then engage students in a discussion of their definitions in comparison to the findings of this study. A third suggestion would be to discuss the why these attributes were defined as most desired by practitioners in this study, for example, why would practitioners say that “being concerned with the consequences of one's actions” is a desired trait?

During instruction, there may be a number of instructional methods one could use including lectures, readings, discussion, case studies, etc. Regardless of which format is used, the teacher can hone in on how the individuals in the case study 1) displayed professional behavior (or failed

to), 2) were concerned with the consequences of their actions, 3) were honest (or dishonest), and so on. For example, students can engage in learning activities that make them aware of the consequences of actions to other, even when there are several degrees of separation between action and consequence. Students can be required to identify consequences in terms of consequences to individuals, groups, and society at large. Furthermore, students can be required to identify consequences in terms of personal harm or injury, as well as social impact. Students can be required to investigate the causal links that enabled the consequence. Students can be required to develop a manifesto that expresses their intentions with regard to actions they will take to concern themselves with the consequences of their actions.

VI. Suggestions for Future Work

There are several possible directions for future work. First, we recognize that we had a relatively small sample size; a similar study with a larger sample size would provide stronger results. In addition, with a larger sample size it would be possible to stratify the sample and analyze the data for differences among practitioners in particular industry sectors, e.g. software/hardware manufacturers versus companies that rely heavily on software and hardware or public sector versus private sector.

It would be interesting to study students' perceptions of ethics and/or a study of the perceptions of recent college graduates once they get into the workplace. A comparison of what students or recent college graduates perceive to be lacking with what practitioners perceive to be lacking might prove fruitful in further understanding the gap that is to be filled in the college curriculum. Another line of inquiry would be more in-depth interviews specifically regarding the attributes that were identified in this study as having the highest index value. Such results

would provide more direction to educators who are being called upon to help close the ethics gap.

Finally, there is additional work needed to help convert results such as these into useful teaching materials. Work is needed on identifying ethical situations that would be good for addressing the higher ranked attributes in the classroom. Because teaching ethics is quite different from teaching computing, additional work is needed to incorporate research on pedagogical approaches best suited for teaching applied ethics.

VI. Acknowledgements

This material is based upon work supported by the National Science Foundation under Grant No. 0313871. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

VII. Endnotes

¹ The concern is that a sense of morality as related to professional practice is insufficient for the workplace; instead of graduating students with a moral sense, we should focus on the further development of students' moral judgment (Johnson, 2001; Martin and Wertz, 1999; Staehr and Bryne, 2003). Moral development is the process of matching one's moral view to one's experience of life in a social world (Kohlberg and Kramer, 1969). Within the moral development life cycle, post-secondary education is expected to play a significant role, especially as it pertains to morality and moral issues pertinent to a students' intended profession. In order to address the gap, educators need ideas of what is missing.

² As an alternative, Dick required students with work experience to develop these dilemmas, then discuss them in the presence of practitioners. (1994, p. 71) He argues that workplace dilemmas frequently have little meaning for students otherwise.

³ Floridi tries to transcend both approaches by introducing a third alternative. (1998)

VIII. References

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