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Student perceptions of ethics and professionalism in computer science: Does age, gender, or experience matter?

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STUDENT PERCEPTIONS OF ETHICS AND PROFESSIONALISM IN
COMPUTER SCIENCE: DOES AGE, GENDER, OR EXPERIENCE MATTER?

A Dissertation

Submitted

in Partial Fulfillment

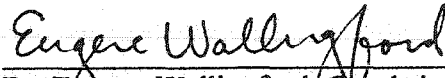
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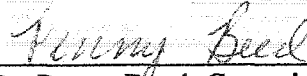
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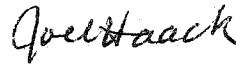
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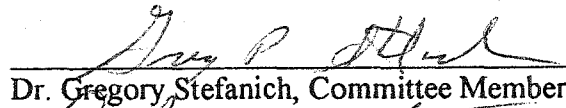
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December 2003

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STUDENT PERCEPTIONS OF ETHICS AND PROFESSIONALISM IN COMPUTER
SCIENCE: DOES AGE, GENDER, OR EXPERIENCE MATTER?

An Abstract of a Dissertation
Submitted
in Partial Fulfillment
of the Requirements for the Degree
Doctor of Education

Approved:


Dr. Sharon Smaldino, Committee Chair


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ABSTRACT

This work explores several factors that impact ethics education in undergraduate computer science, including: the overall understanding of ethics material, any differences between male and female subjects, any differences between traditional age and non-traditional age subjects, and any differences in experience level. Instruments (attitudinal surveys and reflective scenarios) were distributed to four institutions in the Midwest; 74 out of 170 were returned.

Female subjects demonstrated a markedly better ability to distinguish between ethical and unethical behavior in the scenarios (especially in areas where the distinctions were less obvious) and produced higher quality written justifications. There were only 4 attitudinal survey items where differences were found between the genders, each attributable to the different sizes of the groups (though the split, 63% male and 37% female, is fairly consistent with current computer science enrollment data).

Based on attitudinal survey responses, nontraditional students demonstrated a clearer understanding of the relationship between academic honesty and ethics than did traditional age students. Other differences existed, but were primarily due to the vastly different group sizes (84% traditional age, 16% nontraditional age). In the qualitative data, the two groups responded similarly to all but one scenario; the writing of the nontraditional students tended to be of more consistent quality.

Among the experience levels, differences were found on several survey items and in the response patterns on all of the scenario data. The same general trend evidenced itself in both cases; freshmen (those who have taken/completed less than 3 courses) displayed a

greater ability to correctly distinguish ethical and unethical acts, and responded to the acts more clearly and concisely than their more experienced counterparts. The pattern declines steadily through the juniors (7 to 9 courses) and rebounds slightly for seniors (10 or more courses).

DEDICATION

This work is dedicated to three people. First, to John Arthur Bohy, Jr. (my father), whose consistent support and passion for education were constant sources of inspiration. Secondly, to my wife Heidi Ann, whose undying devotion, support, and love have made this pursuit possible over the first six years of our marriage. Finally, and most importantly, to my Lord and Savior Jesus Christ, without whom none of this would have been possible.

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CHAPTER 1

INTRODUCTION

Consider the following situation. A computer programmer working as a consultant enters into a contract to develop a major application. As the deadline for product delivery approaches, she realizes that she will not be able to finish the job. In her mind, she has three alternatives. She can ask for additional time to complete the project properly. She can complete the implementation, but not adequately test it. Or she can deliver only the portions of the product that have been adequately tested, leaving features out of the program.

This type of scenario can be presented to undergraduate computer science students in a number of fashions. One possibility is to present it as it is presented above, and then ask the learner to choose which decision the consultant should make and why. Clearly there is no suggestion of the intent or motive of the consultant in the scenario as it is presented here. In fact, much can be learned from the students' responses in terms of how they might interpret intent or motive in such a scenario.

Alternatively, if the idea of motive is added, the way the scenario can be used changes dramatically. From one perspective, the motives of the consultant can be "pure," in the sense that she intends to fulfill her responsibilities to her employer to the best of her ability. This is simply accomplished by adding a sentence to the end of the paragraph, such as "She recognizes the impact that proper completion of this project will have on

her reputation as a consultant, and wishes to do the best job possible.” If learners are then asked to evaluate in terms of which decision she should make, they must take this idea into consideration.

The same scenario can also be used to display less than responsible motives on the part of the consultant, implying that she is primarily motivated by some force other than professionalism (e.g. money) or doing the best possible job. As an example, suppose that instead of considering the three alternatives, she makes the decision to deliver a product that has not been adequately tested. Further suppose that she deliberately does not inform her client that the software has not been adequately tested. Now the learners can react to the situation and make specific comments on the scruples of the consultant.

They can consider whether her act is justifiable or not, and if so, under what circumstances.

The purpose of such an exercise is to somehow assess the learners’ understanding of professional ethics and responsibility in a computer science context. It is important that undergraduate computer science majors develop such an understanding during their course of study (Austing, Barnes, Bonnette, Engel, & Stokes, 1979; Roberts & Engel, 2001; Tucker, 1991). Whether this should be an explicit or implicit part of the curriculum at a given institution is not necessarily up for debate here. The issue at hand is purely that of effectiveness of current curriculum in addressing these issues.

In their three most recent set of curriculum guidelines for undergraduate computer science programs, the Association for Computing Machinery (Austing et al., 1979) and ACM/IEEE-computer science Joint Curriculum Task Force (Roberts & Engle, 2001; Tucker, 1991) have made a point to include material (to varying degrees) regarding the *social and ethical context* of computing. In *Curriculum '78*, it is noted, "few will disagree that professional computer scientists should be instructed to evaluate social issues regarding that which they do" (Austing et al., 1979, p. 155). The authors noted the two most common objections to teaching this material in a separate course; the material isn't really computer science and should be taught in a social science course, or while the material is important, it is so important that it should be integrated throughout the curriculum. A course (CS 9) devoted to this material was proposed, and strongly suggested as a required course unless departments were doing a good job integrating the material (Austing et al., 1979).

In *Curriculum 1991*, the committee asserted that undergraduates "should understand where the discipline has been, where it is, and where it is heading" (Tucker, 1991, p. 11). This was not to suggest that the approach to this material should be merely from a historical standpoint, but that the history provides an interesting lens through which to view the discipline of computing as a whole. *Curriculum 1991* marked a departure from earlier ACM recommendations in that it did not attempt to define particular courses, but rather specific units of knowledge which were to be part of the courses of study. Four

units (which will be discussed later) related to the social, ethical, and professional issues were laid out (Tucker, 1991).

The most recent set of recommendations, *Computing Curricula 2001*, expanded the number of knowledge units from 4 to 10. It was noted that

As we enter the 21st century, an unprecedented opportunity exists to make professional practice a seamless part of the curriculum in computer science and other computing disciplines. Understanding professional practice is critical for most computer science students since the vast majority will enter the workforce upon graduation. (Roberts & Engel, 2001, p. 55)

In defense of this rhetoric, they offered the results of a 2001 survey by the National Association of Colleges and Employers (NACE), which listed honesty and integrity as the second-most desired quality of prospective employees (behind written and verbal communication skills). “That employers are [seeking] candidates with these general qualities underscores the importance of making professional practice a central component of the curriculum” (Roberts & Engel, 2001, p. 55). The sentiment here is echoed by Preston (1998), who noted that one of the problems encountered by educators is “the necessity of [computer ethics] teaching,” (Preston, 1998, p. 60) and that “[o]ne consequence of ignoring this question can lead to institutional neglect.”

It is not only employers that desire a high level of professionalism from graduates of computer science programs. It has been noted that “[a]s software products begin to pervade our environment, the risk that they will cause a great calamity increases significantly” (Spinello, 1997, p. 198). The implication is that consumers of computing

technology have high demands of computing practitioners as well. *Computing Curricula 2001* resonates with this sentiment and goes so far as to include an entire chapter on professional practice in the curriculum. It is noted that “[t]he growing demand for better, less defect-ridden products has also increased the pressure to incorporate professional practice into the curriculum” (Roberts & Engel, 2001, p. 56). Part of this demand stems from application of sound software engineering procedures; part from a need for practitioners to have a high degree of integrity when working with clients and consumers.

The need to incorporate professional practice into the curriculum takes on an even more urgent meaning in the current climate. The advent of certification procedures like Microsoft’s MCSE (Microsoft Certified Software Expert) and other similar programs has caused some to reconsider the need for an undergraduate degree. This notion is supported by Young (1999), who noted that many young people opt out of pursuing a four-year degree in computer science. Many so-called “hi-tech” companies are so desperate for employees that they are taking individuals right out of high school, luring them with high paying jobs and the promise of training. This training is typically narrowly focused on whatever task the individual is hired to do. If they are to be promoted, they then pursue further training. Thus, it would seem that there are few reasons for the average high school student who is considering a career in computing to consider pursuing a formal education in that field.

Unfortunately, this view of computer science as primarily a vocational/technical field has advocates from within the educational establishment as well. A relatively young discipline (the first PhD in computer science was granted in 1968), computer science continues to fight for acceptance within the liberal arts. Ferren (1993) notes the perception that even the inclusion of computing within general education at liberal arts schools smacks of “creeping careerism” (p. 166) among many liberal arts faculty. In fact, many claim that computer science is not a liberal arts discipline on the grounds that “computer science cannot claim to liberate human potential the way the traditional [liberal arts] disciplines such as art and philosophy do” (p. 166).

This brings up a dichotomy that is somewhat (though not entirely) unique to the discipline of computer science – the need to balance what is pedagogically appropriate with the demands of industry. That Microsoft has developed programs like MCSE is no accident. Bill Gates himself is not an advocate of undergraduate computer science education. When asked if majoring in computer science was the best way to prepare for a career in programming, he responded,

No, the best way to prepare is to write programs, and to study great programs that other people have written. In my case, I went to the garbage cans at the Computer Science Center and I fished out listing of their operating system. You’ve got to be willing to read other people’s code, then write your own, then have other people review your code. (Astrachan, 2000, p. 216)

Computer science enrollment has had its peaks and valleys for the past fifteen to twenty years (Klawe, 2002). But it seems clear that the development of these

certification programs has ramifications beyond draining enrollment at undergraduate institutions. The fact is that computers are ever-increasingly being put into positions of performing life and mission critical tasks. Those who develop the software to complete these tasks are liable to some level for their correctness. It is doubtful that anyone wants someone with a high-school education and a couple months training piloting their plane or removing their appendix, except maybe in extreme emergencies (Spinello, 1997).

While this is certainly a commentary on the state of computer science in higher education in general, it also makes a statement about computing professionalism and ethics in particular. Computing will likely never be considered to be a profession, so long as the industry is willing to accept this type of training as standard practice (Martin, 1998). Furthermore, without clear guidance, those who jump right from high school to a job in computing will have had little (if any) exposure to computer ethics (or indeed to ethics in general). Their guidance in this area will come from those who train them, and possibly those who supervise them. It is not unreasonable to presume that this sort of material will *not* be part of their formal training.

The major concern here is that computer science education has been typically reactive to such trends rather than proactive. Projects like *ImpactCS* (Martin & Weltz, 1999), *Computing Curricula 2001* (Roberts & Engel, 2001) and previous efforts (Austing et al., 1979; Tucker, 1991) have done much to define what the curriculum should be and have even gone so far as to suggest how ethics should be integrated into the curriculum

(Chapter 2 will explore these suggestions in more detail). Clearly, the need for the inclusion of ethics in the computer science curriculum has been reiterated extensively in the past four-to-five years, making it a fairly hot topic of much discussion in the computer science education community (Appel, 1998; Engel & Shackelford, 2001; ImpactCS, 1999). As long as computer ethics and professionalism remains a mere discussion topic, however, little progress will be made in the way of infusing the material into the curriculum. There is a need for a clear vision to address a number of issues. How should the computer ethics curriculum be offered? Who should be teaching computer ethics? What methods work for the teaching of computer ethics, and how are those methods best put into place. Is computer science even a profession that warrants certification and licensure? While these questions are beyond the scope of this particular study, they do lead to some discussion of what the computer science education community must do.

The Role of Computer Science Education

In general, undergraduate education can be viewed both as a means of broadening the mind and as preparation for a profession (Ferren, 1993; Lyman 1995). That being said, it seems reasonably clear that the role of the computer science education community is not simply limited to just the inclusion of ethics and professionalism in the curriculum. For example, if one takes the view that undergraduate education is primarily professional preparation, then a strict enforcement of academic honesty should be part of that

preparation. Adair and Linderman (1985) developed an instrument to assess the attitude toward academic honesty in undergraduate computer science programs. In this instrument, several items are design to specifically suggest to the respondents that there are links between academic honesty and their development as professionals. In administering this instrument, the researchers found that students surveyed tended to agree that academic dishonesty (cheating) should be viewed as a violation of professional ethics. Oddly enough, however, this same group of students also tended to agree that cheating was justifiable if a particular class or instructor was perceived as being too difficult. This dichotomy is certainly not unique to computer science, but brings up a number of important issues as the discipline is further exposed (Adair & Linderman, 1985).

In addition to enforcing standards of academic honesty and including ethics material in the curriculum, it is imperative that computer science faculty members are involved in the teaching of material related to ethics and professional development (Austing et al., 1979). More importantly, ethical behavior must not only be taught, but also modeled (Gotterbarn, 1998a; Martin & Wertz, 1999; Roberts & Engel, 2001). A variety of suggestions have been offered. *Computing Curricula 2001* recommends a program which models local and even international work environments, and has specific roles for administration, faculty, and students (Roberts & Engel, 2001). There is emphasis placed on developing of standard practices within the curriculum, team projects, and even

exposing both students and faculty to consulting opportunities. More to the point, it is suggested that “[f]aculty and students can work together by jointly adopting, promoting, and enforcing professional society ethical and professional behavior guidelines” (Roberts & Engle, 2001, p. 60).

Appel (1998) points out that while there has been a lot of talk about ethics and professionalism in the undergraduate computer science curriculum, there has been very little written about what is working and what is not. Instead, many people are making impassioned arguments for a more proactive inclusion of this material into the undergraduate curriculum. A cynic would note that while many of the debates among computer science educators become very passionate, they are also unfortunately quite cyclical. In fact, as Kay (1996) notes, “[a]n obstacle to reasoned curriculum development is the polarization that often arises between curricular innovators and traditionalists” (p. 56). However, simple observation tells us that this is not the case regarding ethics. Rather, the computer science educator community seems to be falling in line with the rest of the computing community. They believe that this material is important, and something needs to be done to infuse it into the curriculum.

However, the need for ethics instruction has not necessarily corresponded to computer science educators running out and including it in their curricula (Bohy, 1993). The notion of instructor reluctance, the availability of adequate materials, and the availability of adequate methods will all be discussed as a matter of course within this study. It is not

the purpose of this study to advocate for any particular method or any particular set of materials, but rather to advocate for the adoption of the inclusion of computer ethics materials into the undergraduate curriculum at some level, whether as a separate course or integrated throughout the entire curriculum. To best arrive at this need, this study explores student attitudes and understandings rather than faculty and/or general curricular concerns.

Purpose of the Study

Gotterbarn (1998a) points out, “[T]he education of computer professionals is incomplete until we teach them to recognize their responsibility as professionals and to use their technical skills in a responsible way” (p. 8). Appel (1998) draws emphasis to the lack of formal *research* regarding ethics and computing (there are, however, a number position papers and anecdotal accounts, which form the basis of the literature review for this study). Consequently, one purpose of this study is to begin to fill this apparent gap in the research (worthy of note is the paucity of research in many areas of ethics education *outside* of computer science, beyond position-type papers). In considering the purpose of the study, the first question becomes one of perspective.

Within the context of undergraduate computer science education, research on the inclusion of ethics material into the curriculum could be viewed from one of four perspectives: placement of the material within the curriculum (a separate course vs. an integrated approach), instructor considerations (Bohy, 1993), pedagogical comparisons,

or student considerations. This study will not explore inclusion of ethics and professionalism material into the curriculum from the point of view of the instructor. In addition, the results obtained through the course of this study will not advocate the use of any particular teaching methods, nor will it address issues of instructor reluctance, curricular placement of the material, or other issues related to ethics and professionalism in the undergraduate computer science curriculum. While it may be worthwhile to consider these primarily instructor-oriented issues in future work, it is not the goal here. The primary reasons for this decision are: (a) the majority of papers published in the area of computer ethics in the undergraduate curriculum are related to pedagogical comparisons and/or advocacy for a particular methodology; (b) sufficient work has been done on the sources of instructor reluctance toward the teaching of ethics in undergraduate computer science programs; (c) placement of the material within the curriculum has been a matter of much debate within the literature and would be an interesting study, but not time-effective; and (d) most of what passes for research in this area of study has been focused on the instructor.

In fact, this researcher's previous work (Bohy, 1993) was instructor and pedagogy focused. In essence, it can be stated that several techniques exist for presenting ethical and professional material to computer science undergraduates, and to this point all seem to have value. Of some interest are student attitudes toward pedagogical tools used in presenting ethics material. To that end, some data regarding this was gathered in the pilot

study, which was relatively easy to do since the researcher was the instructor for a course which applied a variety of methods for teaching the material. It was not practical to gather this sort of information for this study. The pilot study data in this area will serve as the basis for a future work.

Overall, the main purpose of this study is to examine student attitudes toward and understanding of ethics and professionalism in the computing curriculum. The primary questions being addressed in this study are as follows:

1. Are undergraduate computer science students aware of a relationship between academic honesty and professional ethics?
2. Is there a difference between traditional and non-traditional age college students in terms of attitude toward and understanding of professional ethics?
3. Is there a difference between males and females in terms of attitude toward and understanding of professional ethics?
4. Is there evidence that students gain increased awareness of the importance of ethics as their experience level increases (i.e., as they progress through the undergraduate curriculum)?

Limitations of the Study

There are a number of issues that could be perceived as potential limitations to generalizability of the results of this study. The limitations fall into two broad categories. The first type were those factors that were chosen intentionally; these include the type of

institution from which the sample was chosen, the lack of incentive offered for completing the survey, and the implication of the fourth research question regarding progression through the curriculum. The second group is comprised of issues that arose after the sample was gathered; these include factors related to the relative imbalance of the return rates from the four institutions (disparate sizes of the nontraditional and traditional age, and false positive results) and factors related to demographic data (having taken an ethics course, work experience, and having transferred) that was collected.

One of the original conceptions of this study was to survey computer science students at a wide variety of institutions; public and private, independent and affiliated, large and small. Ultimately, the choice was made to choose the sample from four institutions that were similar in size, mission, CS curriculum, and affiliation. All are small, private, church-affiliated liberal arts colleges located in small cities in the Midwest whose curricular models are consistent with the ACM/IEEE model. This was done in the interest of controlling for potentially confounding variables.

While the overall rate of return for this study (74 out of 170, or 44%) is acceptable for survey research, the return rates from the institutions were not balanced; two of them had reasonably high rates of return of 58% (23 out of 40) and 80% (36 out of 45), the others were much lower at 15% (8 out of 55) and 23% (7 out of 30). Of particular concern is the fact that the third institution in this list, with its return rate of 15%, is the one with the largest proportion of non-traditional age students. This results in a very uneven split

among traditional and non-traditional age subjects (84% and 16% respectively). Even if this is a representative split (and it is unclear from relevant literature as to whether or not this is the case), such a wide difference does represent a significant challenge to the usefulness of any comparisons between the two groups. The overall imbalances between the institutions also lead to a number of false positive results. Changes were observed among various groups that further analysis showed to lie primarily along institutional lines, yet overall differences within the four institutions were not found.

The choice was made in this study to not offer any particular incentive for participating in the research, as such incentive was perceived to be a threat to the results of the pilot study conducted in the spring of 1999. Even the lack of incentive provides potential threats related to the sample as a whole. Without some external incentive, the sample is entirely made up of those who cared enough to actually complete the instrument (or at least turn it in). This is a plausibly serious threat to the generalizability of the results; there is at least potential for extreme bias for or against the subject matter of the instrument. This problem did not evidence itself to any measurable extent in the data gathered in this study.

Another potential threat related to the incentive issue is the answer to this question; did the subjects make an honest effort in completing the instrument? One method of measuring this is by the responses to the reflective scenarios. At one level, consider the number of subjects who chose not to write anything for the reflective responses. There

were six subjects who failed to write something for all of the scenarios; three of them wrote responses for some, the other three wrote nothing at all (one of these also chose to provide no demographic data, just survey responses). This is well less than 10% of the sample. From this vantage point, then, it appears that the participants took the survey seriously. Another perspective is the quality of those responses that were written. Chapter 4 discusses the writing quality in more detail, but it can be noted here that while the quality was not outstanding, it was the opinion of both individuals who reviewed the responses that an honest effort was made in completing them by this set of subjects.

In collecting demographic data on the subjects, an attempt was made to control for three factors: work experience, having taken an ethics course, and having transferred from a different type of institution (i.e. a community or vocational/technical college). Each of these represents an attempt to control a confounding variable (the perceived need to control for these items arose from the pilot study). Of the three, only having taken an ethics course evidenced itself at a noteworthy level (39% of the subjects had completed such a course as part of their general education program). In the case of work experience, only 20% of the subjects were currently employed (90% of nontraditional and 6% of traditional age subjects). Only 9% of the subjects were transfer students.

Of particular concern is the factor of employment. Based on 6 years of experience in teaching nontraditional age learners, this researcher has observed that they are most often employed in the field prior to beginning their study of computer science. Those

individuals are pursuing a degree in computing primarily because their employers have made it clear that it is to their benefit to do so. The reasons vary. Some are pursuing a promotion, others are simply seeking a salary increase, and still others believe their employer just wants to see if they will “jump through a couple more hoops” (as one rather cynical student put it). Thus, the perceptions of these individuals regarding issues of professionalism and ethics may already be fairly well formed, given their experiences in the field. It is not clear what effect, if any, being employed in the field has on traditional age students (whose experience is often working for the information services department for their school or some form of internship). With only 6 out of 64 traditional age subjects currently employed in the field, it is also unclear that the results of this study will shed any light on the subject.

The final potential threat discussed here is the question of change due to progression through the curriculum. For a change in anything over time to be most effectively measured, it would seem that a longitudinal study would be most appropriate. To compensate for this, the notion of progression through the curriculum is defined as experience level, and is related to the number of courses each individual has completed and is currently taking in computer science. As such, any conclusions drawn about change due to progression through the curriculum via this study must be taken at face value. The conclusions are only valuable within the context of the data gathered. It will not be suggested that individual student attitudes will have been changed through the process of

their education; such results simply could not be derived from the data gathered in this type of study. Instead, this study considers the attitudes and perceptions of those who are currently at each experience level within this sample and how they compare.

It is not the opinion of this researcher that any of the aforementioned potential limitations are major liabilities to the value of the results in this study. There were large enough sub-samples in most cases to provide a limited amount of generalization. With the exception of the traditional/nontraditional age groups, the sub-samples (gender and experience level) were relatively proportionally representative. Statistical tools will play an important role where appropriate. Mean responses will be computed for Likert scale items, both to provide some general picture of the distribution of responses as well as for use as a means of comparison between or among various groups. In general, however, more reliance will be placed on the qualitative nature of the data. This may be the most noteworthy threat to the generalization of these results. The primarily qualitative nature of the data gathered here probably limits (or even prohibits) extremely broad generalizations. The intent here is to paint a single perspective picture of the population being studied and offer conclusions relative to it, not to do a three-dimensional rendering and attempt to offer incontrovertible proof that can be applied to all.

This position is supported by Wolcott (1988), who notes that “in and of themselves, ethnographic accounts do not point the way to policy decisions; they do not give clues as to what should be done differently, nor do they suggest how best to proceed” (p. 203).

Instead, the attention is focused on the current state of the situation and what happened to get it to this point. Educators (and as a result educational researchers) often tend to be more focused on what their discipline can become, not how it got to where it is. In effect, while this is not a purely ethnographic (qualitative) study, it does borrow some techniques, which is a perfectly acceptable thing to do.

Perhaps more to the point, in the opinion of this researcher, is the danger of making *any* overly broad generalizations in an educational study. There is simply too much variation among individuals to effectively categorize them beyond gender. Such terms as “nontraditional student” have little meaning to those who are classified that way (and even seem to offend some of them). This lack of faith in generalizations is likely a result of the (somewhat limited) formal mathematics background of this researcher. Thus, the qualitative approach is seen as an excellent compromise, offering an interpretation of the current state of affairs and suggesting general directions in which to proceed.

Terminology

It is appropriate at this point to define a number of terms that will be used frequently in the course of this study. Computer science (often abbreviated CS) has a number of definitions (Denning et al., 1989), but it is not the intent of this document to provide a formal definition of the discipline. Instead, this term is used in a generic sense, covering any number of undergraduate majors that include computer science, computer information systems, management information systems, information technology, and various other

names. The keys are that the primary coursework for the major be offered through a computer science department, and that the curriculum be modeled after the ACM/IEEE curriculum recommendations.

The term "lab assignment" in computer science typically implies a programming activity of some sort. It is not important whether a closed (a scheduled period each week during which students meet with an instructor) or open (where no formal time is set aside) lab setting is being used in a given course for the purposes of this study. In the study, this term is used most often in the survey instrument to be completed by the students, and will be familiar to them. Academic dishonesty is defined to be any type of cheating; copying of programs is probably the most prominent example in computer science.

Computer scientists have a great affinity for acronyms, and a number of them will appear in this study. Among those the reader will see most frequently are related to the various professional societies: ACM (Association for Computing Machinery), IEEE (Institute of Electrical and Electronics Engineers), CPSR (Computing Professionals for Social Responsibility), DPMA (Data Processing Management Association), and American Federation for Information Processing Societies (AFIPS). Most of these organizations have codes of conduct which are of interest in framing this study.

In the context of the pilot study, a fairly informal and anecdotal definition of "non-traditional" was used, the primary criteria being that of age. It turns out that the standard

age cut-off is 25 (Pearson, 2000). For a more formal definition, it is noted that “‘Older than typical’ is defined as students 20 or older in their first year, 21 or older in their second year, 22 or older in their third year, or anyone 23 or older” (Pearson, 2000, p. 14). The National Center for Educational Statistics has published a list of factors which make students more or less non-traditional. Age, employment, and family support are the primary factors, but in general, an age of 25 or older is a standard accepted cut-off point (Pearson, 2000). In the sample, there was a significant gap in terms of age between the traditional age (18-22) and non-traditional age (29-48) students, which further facilitates the use of age as the primary distinction between the two groups.

Academic standing was initially going to be used as the category to measure the change in attitude attributable to maturation. The main problem with using academic standing was that experience level in computer science classes did not necessarily always map well onto the academic classification; some start the program of study the first semester, others wait a year or more. Each of the institutions participating in the study has a computer science program that involves 36-42 semester credit hours (12-14 courses) in computer science. Subjects were asked to report the number of computer science courses they had completed, and the number they were currently taking. These two numbers will be added together to create some picture of experience level: 0 to 3 courses is a freshman, 4 to 6 a sophomore, 7 to 9 a junior, 10 or more a senior. This allows for a more evenhanded comparison of the experience levels of the subjects.

CHAPTER 2

REVIEW OF THE LITERATURE

Aside from *Project ImpactCS* (ImpactCS 1999; Martin, 1996; Martin & Weltz, 1998), little, if any, formal research has been done on the teaching of ethics in undergraduate computing programs (Appel, 1998). In fact, the primary thrust of *Project ImpactCS* was to address some of the inadequacies of *Computing Curricula 1991* (Martin & Weltz, 1999), in terms of the amount of time devoted to and the knowledge units covered in the study of ethics. The bulk of the literature in the area of ethics education is in the form of textbooks, position papers, and anecdotal accounts of what does and does not work well for teaching the material (Bear, 1986; Bellin, 1995; Lelewer, 1994; Riser & Gotterbarn, 1996). This is a significant observation, and should neither be taken too seriously nor too lightly. On one hand, this paucity of existing literature provides this researcher with very little upon which to base the study. On the other hand, this lack of a strong basis may well introduce a great deal of freedom in terms of how this study is conducted, as well as suggesting ideas for future research in this area.

Essentially three divisions exist within the literature on ethics and professionalism in the undergraduate curriculum: (a) the question of what pedagogical approaches exist for teaching ethics material, (b) the question of whether or not computing is a profession (and if so, what are computer science educators to do about it?), and (c) the question of content (what should computer science educators be teaching in terms of ethics and

professionalism?). Two research studies that have been completed in the areas of student attitudes toward academic honesty and professional ethics (Adair & Linderman, 1985) and identifying areas of ethical conflict in computing technology (Parker, 1979) will be described in relative detail in this chapter, as they provide the basis of this study.

Needs and Obstacles

Why is it even important to teach computer ethics? To answer this question, it is important to consider just exactly what ethics is. Ethics is “the rules of conduct recognized in respect to a particular class of human actions” (Johnson, 1984, pp. 22-23), and the term ethical implies relatively strict adherence to an accepted set of common moral guidelines (Dejoie, Fowler, & Paradice, 1991). In some sense then, according to Johnson (1984), the need is derived from the impact the machines have had on society and on our lives. Society has moved from “being a service-oriented society to a computer dependent society” (Johnson, 1984, p. 23), but this move has not seen the evolution of an adequate morality. As society continues to become more individualized, it must maintain its responsibility to maintain the rights of all citizens.

Moving further back, computer science educators need to consider the basic tool set that undergraduates come in with. Kilpatrick (1992) notes that many will graduate from K-12 schools with woefully inadequate understanding of even the most basic ideas of right and wrong. While many of the examples cited seem extreme, at the very least they remind us that incoming students arrive with a variety of backgrounds and baggage. Some

learners will have only been exposed to situational ethics, others will have had little or no formal instruction on the difference between right and wrong, and still others will have grown up with a strictly black and white view of morality. The goal of educators is to find the balance among these three worldviews.

Barbour (1993) contends that there are three broad views of technology in the social context. On one end are the optimists. These are people, typically those writing futuristic works, who believe that society will be transformed in the same way by the information revolution that it was by the industrial revolution. They tend to see society flattening as a whole -- both socially (class divisions will disappear) and organizationally (hierarchies will flatten). They see the world getting smaller (the concept of the global village) and an overall improvement of the democratic process (Barbour, 1993).

At the other end of the spectrum are the pessimists. This group usually includes social scientists and a few computing professionals. Driving their thinking is the notion that technology gives those who are already in power even more power. Technology does not close the gaps between the classes in a society; it widens them (and produces more of them). Automation of tasks leads to a loss of jobs for unskilled laborers. They do not directly perceive the concept of the job shift (that as jobs are lost in one area because of a fundamental change in the base of the economy, they are created in another) as discussed by Rosenberg (1992). In the broad sense, the pessimist believes that people enjoy fewer freedoms. This world-view is borderline Orwellian (Barbour, 1993).

Neither the optimistic nor pessimistic view is terribly realistic, as is often the case with such extreme viewpoints. Rosenberg (1992) sites a number of social and economic studies that show both to be questionable. The more realistic choice is the contextualist view. People who advocate this view do not accept the deterministic views of economy and technology purported by the pessimists. Unlike the optimists, they more closely consider the social consequences of technology, within the context of their development. Barbour (1993) believes that the contextualist viewpoint is likely the closest to the truth. The bottom line is that all three of these worldviews need to be part of the knowledge set for those considering careers which involve technology. Such knowledge will assist the computing practitioner not only in making informed decisions, but also in communicating with people from each view (Barbour, 1993).

It is also appropriate to consider a pertinent statement from one of the many texts reviewed for this study; “[A]s society becomes more dependent on computers and computer networks, we have also become more and more vulnerable to computer malfunctions” (Forrester & Morrison, 1994, p. 1). These malfunctions have created whole new classes of social problems. The overriding notion seems to be that computing practitioners cannot isolate themselves from society. According to Spinello (1997), the prevailing issues are “ownership of intellectual property, the security of networks and computer systems, and the obligation of high tech vendors to provide safe, reliable programs while eschewing false product announcements” (Spinello, 1997, p. 1). These

items are further broken down and defined by a number of authors (Forrester & Morrison, 1994; Neumann, 1995; and others) in terms of reliability (what factors need to be considered during the design process, especially human factors?), liability (if and when problems arise, who is responsible?), malfunction (while it is not possible to account for all potential problems, have we accounted for as many as we possibly can?), and misuse (for what purpose is the product being designed? Is it possible to use it for some other purpose, and if so, should it be?). All of these issues make the study of computer ethics essential to the future practitioner.

Most authors cite the importance of the study of general ethics. Beginning with Kant's Categorical Imperative (Ermann, Williams, & Gutierrez, 1990; Spinello, 1997) and moving through such topics as ethical relativism, utilitarianism, and deontological ethics (Bowyer, 1996; Spinello, 1997), most computer ethics texts include at least a minimal introduction to topics in general ethical principles (Bowyer, 1996; Ermann et al., 1990; Spinello, 1997). But the more important, more common theme is that there needs to be some mention of professional ethics (as it relates to careers in computing). Bowyer (1996) maintains that professional ethics are comprised primarily of a series of relationships, between the professionals and their clients, the overall profession and the society within which it operates, within the profession, and between employers and employees. Finally, it is important for the professional to consider any "specialized technical details of the profession" (Bowyer, 1996, p. 5).

As to whether it is essential that general ethical theories be taught as a foundation to theories for information ethics is not entirely clear. The majority of textbooks reviewed by this researcher as well as those textbooks reviewed by Tavani (1996) do contain at least some general ethical theory. Even in those texts which do not, significant time is devoted to the development of the major ethical concerns in computing and/or information systems ethics, and there is at least mention of general ethical principles. As to what principles or ethical theory should be taught, there is also variation (though most seem to advocate the respect for persons and/or utilitarian approaches). This all seems to be in harmony with the framework suggested by Parker (1979), which certainly has room for some individuality (e.g., if an individual has personal objections to some policy and they do not conflict with general ethical principles, it is right to follow them), but mostly seems committed to the notion that right and wrong do exist in computer ethics.

Two major hurdles exist which need to be overcome. Firstly, many learners wish to challenge the idea that there should be an established standard of ethical behavior within the computing profession. These people will make such arguments as, "well in this case, I suppose the act is unethical, but if the circumstances were slightly different," or "I can see why the guy would do that. I'd do the same thing in that position." The difficulty here for most learners (and even some professionals) is that, "living ethically is often not easy to do ... it requires strong and sincere motivation" (Bowyer, 1996, p. 7).

The other major hurdle, instructor reluctance, is based on similar problems and attitudes. There are a number of sources of instructor reluctance cited in the literature. Many instructors express reluctance to teach this material simply because they believe they lack proper preparation. Cunningham (1986) suggests that two types of people are typically asked to teach computer issues-related material – either those who are retrained liberal arts faculty who lack the background with technology, or those computer scientists who simply are not comfortable with the more or less traditional methods for teaching ethics material. In addition to their lack of familiarity with the teaching techniques, instructors also feel inadequately prepared to evaluate the work of students, especially using group-oriented discussions or writing assignments (Schulze & Grodzinsky, 1996). Bear (1986) also adds that reluctance may stem from a lack of appropriate and effective materials to teach issues related materials, and believes this to be the primary reason for instructor reluctance. Given the recent flurry of activity in the development of texts and other materials, this is likely no longer a legitimate reason.

Another potential source for instructor reluctance may very well be the nature of the material itself. In some sense, the teaching of ethics requires computer science educators to teach very specific values. Whether or not computer science educators are equipped to deal with the idea that some things may be *absolutely* right or wrong is not easy to determine. In all likelihood, they are going to apply so-called *situational ethics* in an effort to demonstrate that there are not absolutes. While addressing this issue is not a direct

goal of this study, it is worth consideration in the future, as more materials (especially case studies and similar scenario-based items) are developed. Moreover, it will be an important question for those teaching this material to answer (Bear, 1986; Bohy, 1993; Cunningham, 1986; Johnson, 1994; Parker, 1979; Schulze & Grodzinsky, 1996).

Pedagogical Approaches

A number of appropriate methods can be used by those wishing to incorporate the study of computer ethics into the curriculum at the undergraduate level. Educators at all levels (elementary, secondary, and post-secondary) have developed methods, most of which are not necessarily restricted to use in the setting in which they were developed (i.e., an elementary school approach can be used at the undergraduate level with some minor changes). Some of the methods focus on specific issues, while others are more general purpose. The focus of this review is not to suggest that any one method is better or worse than the other, but to note that while there are a number of methods, research on them is lacking.

Troutner (1986) developed a set of methods, used in a middle-school computer literacy course, which have potential at the undergraduate level. The methods developed are categorized by the issue being studied: equal access to resources, computer crime, and privacy. A particular strength of these methods is that they incorporate both individual activity as well as class discussion time. For example, the lesson regarding equal access puts the students into a situation where they have to consider policies on access and

suggest potential changes. Such methods could be adapted to take various physical and mental disabilities into account, as well as economic inequities.

King and Nolen (1985) claim that conventional, teacher-centered approaches (e.g., lecture and demonstration) are sufficient for use in teaching technological concepts in the study of ethical issues. The rest of the material (e.g., legislation, regulation, and ethics) can be presented in a seminar format. A variety of activities can be used to further student learning and to integrate issues-based material throughout the curriculum, including: programming assignments involving security issues, research papers, opinion papers, debates, panel discussions, and book reports (King & Nolen, 1985). These are similar to the recommendations made by participants in the last two iterations of the ACM curriculum recommendations (Engel & Shackelford, 2001; Tucker, 1991).

The case study approach is advocated by a number of authors (Anderson et al., 1993; Benbunan-Fich, 1998; Epstein, 1995; Spinello, 1997). A major strength of this approach is that it gives the learners real world situations to deal with, but the primary weakness is that these approaches do not engage the learner in a meaningful way with the issue at hand. As an alternative, Artz (1998b) offers the use of stories or narratives. He asserts that stories are important tools to be used in the pursuit of the truth, that logic alone is not sufficient in most cases (Artz, 1998a). However, he also points out that there are few useful stories, and that (as with so many other techniques associated with teaching/learning ethics) the classroom techniques (such as unstructured discussion, role

playing, and literary analysis) for using stories properly need to be learned by the instructor. Unless s/he is willing to learn them and take them seriously, the approach does not go well (Artz, 1998b).

Schulze and Grodzinsky (1996) found success with a number of pedagogical approaches. While they are able to recommend a number of the same methods already listed here (e.g., interactive discussions and writing assignments), they also suggest a number of other engaging activities. On-line discussion forums, especially those which are created between different institutions, worked very well (and can be more easily facilitated using course management systems like WebCT). They also suggest that the careful use of analogies can be effective; creating a parallel between someone looking through an individual's computer files and the same person looking through their private home and other such issues can have very demonstrable effect. Finally, the use of dramatic presentations, or "playlets" (Schulze & Grodzinsky, 1996, p. 99) can have a positive effect.

A final approach suggested by Bohy (1993) for use in teaching ethics and other issue-based material in computer science is structured controversy. Originally developed by Johnson and Johnson (1974) for use in middle school science classes, the method is similar to debate in that learners are divided into two teams on either side of an issue. It differs significantly from debate in two ways. First, the learners end up presenting both sides of the issue in question, switching perspectives after each side has had a chance to

present its case. Second, the ultimate goal of the activity is consensus, instead of one side or the other winning. Again, the challenge here is for the instructor, who must be very well prepared and ready/willing to enforce the rules of the activity and not let it degenerate into a debate.

As part of the pilot study which guides this work, this researcher used three group-based instructional activities in a systems analysis and design methods course taught during the spring 1999 semester. Students were assigned to one of three groups: one which role-played a situation involving computer ethics (involving a scenario where a contract employee does not finish his work on time), one which presented a structured controversy (on the issue of intellectual property theft), and a third which worked on a group research/position paper (on the issue of individual liability). Each group was given time (approximately 5 weeks) to prepare a presentation to the class. Presentations were given on three separate nights, and those not participating in the presentations were asked to evaluate not only the presentations themselves, but the methods used in presenting them as well.

Not surprisingly, both the role-playing and structured controversy activities received the most positive comments from students. One female student noted that she "liked structured controversy better than a typical debate that classes usually assign. The most interesting and useful part in this activity was when the entire group came together and formed a consensus." Most of the observers pointed out that the biggest problem with

the topic chosen (intellectual property rights/theft) for the structured controversy was that it was difficult to tell the two sides of the issue apart. One participant pointed out that “the weakness of this particular activity was the topic. It was difficult just finding the current policy because of its vagueness and so many topics related to it,” but that “a strength of the activity [was] the discussion with the entire class. I thought the questions that were asked were interesting.”

The point of this research is not to advocate for a particular pedagogical approach to teaching issues material. Rather, it is to reinforce the notion that issues material is an important part of the undergraduate CS curriculum. The evaluations of all three activities were generally positive, and indicate a strong desire on behalf of the students to study this material more in depth. The focus of this literature review is to point out a relative paucity of hard research in this area, as well as the potential issues associated with failing to incorporate ethics material into the undergraduate computer science curriculum.

Practitioners or Professionals?

Those making discoveries, developing techniques, and utilizing technology drive the impact computers have on all phases of our lives. For the time being, these people will be referred to as computing practitioners. This may seem strange, since those in medicine, teaching, and engineering who make discoveries, develop techniques, and utilize new technologies are called professionals. At first, it may seem that the difference between practitioner and professional is merely semantic, but it is actually an appropriate focus

for many discussions regarding ethics, professionalism, and social responsibility in computing. Thus, the distinction between a *practice* and a *profession* serves as a starting point for this discussion; is computing (or computer science) a profession?

As a discipline, computer science is young in comparison to more established professions such as teaching, engineering, and medicine. Through this short history, public perception of the computer scientist seems notably unchanged. Martin (1993) writes that historically, the media has shaped public perception of both computers and computer scientists; the stereotypical computer scientist was and still is viewed as something of an anti-social, unethical mercenary (Martin, 1998). As such, in attempting to answer the question of whether or not computing is a profession, Martin (1998) starts by defining a profession as “a “moral community” with shared values and goals ... serving a dependent public with self-regulatory standards established by the group and instantiated in a code of conduct or ethics with expulsion procedures for violations” (p. 7). Each point in the preceding definition is analyzed in order to determine whether computer science is a practice or a profession.

The primary basis of Martin’s (1998) “moral community” is professional organizations. Physicians have the American Medical Association (AMA) and attorneys have state bar associations. Parker (1979) notes that there are a number of organizations that a computing practitioner can join. The broadest in scope is the ACM, which calls itself the “first society in computing,” and has a wide variety of members from industry

to academia. The IEEE has a special interest group devoted to computing and computer science, though its scope is not as broadly ranging as the ACM (there is, however, a good deal of crossover between the two groups). The DPMA is more focused on business and industry concerns. The AFIPS is purely a labor organization. As one of the newer groups, CPSR is an organization focused entirely on social and ethical issues involving computing (Computer Ethics Institute [CEI], 1997).

There are two major difficulties, according to Martin (1998). The first is that there is no requirement that a computing practitioner actually belong to any of these groups. Some argue that one way to address this is through certification and licensure, as in other professions. While this might not lead directly to mandatory membership in a professional society, it might be an intermediate step in that direction. Attempts at licensure in computing began early. Parker (1979) notes that in the early 1970s the Institute for Certification of Computer Professionals (ICCP) did develop some standards for certification (the Certificate in Data Processing program), but it is unclear as to whether this program still exists today. No current (post 1979) references to it can be found. Other attempts to certify computing professionals (such as MCSE) tend to be very proprietary in nature (Martin, 1998).

The other difficulty has to do with consequences. If a physician commits some ethical violation, s/he runs the very real risk of being kicked out of the AMA or (in extreme cases) losing his/her license to practice medicine. Such consequences simply do not exist

in computing. While it is true that the ACM sets very high standards for its members, it is not clear that being kicked out of the ACM carries the same potential career consequences as might exist for the physician who is kicked out of the AMA. In a very real sense, computing lacks the community aspect of professions as defined by Martin (1998).

Martin (1998) identifies two other important components of a profession -- self-regulation and a code of conduct. Parker (1979) notes that there was early recognition of the need for a code of ethics in computing. In 1966, work began on such a code, based on one that was in use by the Engineers Council for Professional Development (Parker, 1979). However, at this time, it was clear to the ACM that the field was too young to completely support such a code. Indeed, it was recognized that it was not fruitful to organize a code of ethics until all (or at least most) of the issues had been identified and fully documented, and some general consensus had been reached on what constitutes ethicality within the discipline (Parker, 1979). Given more recent writings (ACM, 1998), it has become clear that the organization believes these two criteria have been more or less satisfied, the idea being that while the field of computing is in some state of change, the fundamental aspects of computing remain intact. The ACM and other organizations have significantly updated their own codes of ethics to be more reflective of the times. The CPSR has developed a list of "10 Commandments" for the computing professional (CEI, 1997).

However, having a code of ethics and actually enforcing it are two entirely different things. As pointed out by Anderson, Johnson, Gotterbarn, and Perrolle (1993), "ACM [has] had difficulties implementing an ethics review system and came to realize that self-regulation depends mostly on the consensus and commitment of its members to ethical behavior" (Anderson et al., 1993, p. 98). In other words, it is important that the code serve as a foundation, a statement of what is expected of ACM members. The ACM code is educationally oriented, and clarifies to the group what is expected.

Such a code is expected to hold those bound to it accountable, at least to the public. It is to provide a basis for individuals to make decisions (Martin, 1998). However, without certification or licensure, or at least an industry-wide requirement that everyone be a member of a given organization (e.g., the ACM), the professional consequences of being thrown out of the ACM are minimal. Essentially, if a computing practitioner is thrown out of the ACM, what consequences would this have with regard to his/her ability to retain current or gain new employment? It is not clear that there would be any.

Recently, there has been significant movement among computing practitioners toward making computing a profession. The major impetus of this movement has primarily come from the top (i.e., from those already in the field), and to some it may be too little too late (Gotterbarn, 1998a; Martin 1998). According to Gotterbarn (1998a), the development of a moral community cannot occur until there is a more proactive approach to teaching professional and ethical responsibility to undergraduate (and perhaps even graduate)

students in computer science. This is a significant shift in the typically reactive approach of "[i]f it fails, we can always write a patch" (Gotterbarn, 1998a, p. 9) many computing practitioners took in the past. If the goal is the development of computer science professionals, then computer science educators must become involved.

What Should we be Teaching?

What is the essential content of a computer ethics course? This question can be addressed from two different perspectives – the texts available on the subject and the curricular recommendations from the ACM. As previously stated, the majority of texts reviewed seem to consider at least some discussion of general ethical principles as being important. In the way of ethical principles which are specific to computing and information technology, the texts either start with one of the many codes of conduct, or with at least some discussion of foundational principles before delving into particular areas. Beyond this, there seems to be strong agreement as to what other content areas constitute a proper computer ethics course.

The most commonly included subject areas in the texts can be broken into two basic categories: those which directly impact the computing practitioner, and more socio-political issues. Computer crime, computer viruses, software piracy, intellectual property, privacy, reliability and liability, and risks and safety are the areas which most affect the computing practitioner and to which it is easiest to apply more stringent ethical standards (Forrester & Morrison, 1994; Rosenberg, 1992; Spinello, 1997). More social

and political areas, such as gender issues, health issues, civil liberties, employment, quality of life issues, social power, and education raise more difficult questions, and (perhaps) do not as directly impact the future computing professional (Spinello, 1997; Turkle, 1984). Notably lacking in many of the texts, with the exceptions of Dreyfus (1979) and Basse (2003), are discussions of computer dependency and artificial intelligence, at least in the opinion of this researcher. The Dreyfus (1979) text is not a general computer ethics text, but does raise important questions about the future of computing.

In *Computing Curricula 1991* (Tucker, 1991), recommendations were made surrounding the social and professional context of computing. These recommendations were used to create a total of four knowledge units: the historical and social context, professional responsibilities, risks and liabilities, and intellectual property. Though these are fine recommendations in and of themselves, they fall short of the mark in that they are not considered one of the nine major subject areas to be covered within the entire undergraduate computer science curriculum (Tucker, 1991). In addition, very little guidance was given as to how they should be implemented within the curriculum (Martin & Wetz, 1999). Perhaps the most major concern is the lack of time devoted to these areas; “only 11 out of 283 total lecture hours were specified” (p. 8) to be used for this material, a mere 3.9% of the total time.

Thus, among the goals for *Project ImpactCS* was a clearer definition of what this knowledge area should be (the authors of the project state that other goals will be addressed later). The participants recommended the creation of a tenth fundamental subject area, “designated Ethical and Social Impact of Computing (ES)” (Martin & Weltz, 1999, p. 9), which is comprised of five fundamental knowledge units: professional responsibility, basic elements of ethical analysis, basic skills for ethical analysis, basic elements of social analysis, and basic skills for social analysis. One result of this work has been its impact on the most recent ACM/IEEE computer science curriculum recommendations. All 10 of the areas of study recommended by Martin and Weltz (1999) are incorporated into the new recommendations (Engel & Shackelford, 2001). To acknowledge the importance of the material, the report states, “both students and society must be educated as to what they can and should expect from people professionally trained in the computing discipline” (Engel & Shackelford, 2001, p. 56).

A growing number of texts and other supporting materials are available for classroom use. The majority of the resources available are anecdotal in nature, either presenting material in case study form with supporting analysis (e.g., Anderson et al., 1999) or simply as a written narrative (e.g., Spinello, 1997). It is not the purpose of this literature review to formally review these texts, as this has been taken care of to some extent by Tavani (1996). Instead, the content of each will be analyzed to seek out and define common and/or important areas of focus. This will be done from two perspectives: first, an analysis of the texts in light of a framework for ethical decision-making, and second an

informal analysis of the content in the texts themselves. Additionally, the various pedagogical approaches advocated by the individual authors will also be explored (though to a somewhat limited extent).

Frameworks for Ethical Decision Making

Artz (1998b) points out that at the heart of the matter, there are only two underlying issues in computer ethics. The first issue is that of establishing professional standards, and the second is the enforcement of these standards. In light of these issues, we consider three basic frameworks for making ethical decisions in computing. Such frameworks can either be prescriptive, in that they provide some direction as to the choices an individual must make in a given situation; instructive, in that they provide the individual some common characteristics to look for which marks a particular type of conflict in a given situation; or both. Typically, codes of conduct, such as the "Ten Commandments of Computer Ethics," are fairly prescriptive. One exception to this, as shall be shortly seen, is the ACM's code of ethics. However, the discussion begins with the instructive framework, Parker's (1979) areas of ethical conflict.

Areas of ethical conflict. Parker (1979) suggests that there are six areas of ethical conflict in which the computing practitioner must be prepared to make decisions. These provide a basis for further discussion of other frameworks. This framework provides a lens through which professionals can view potential conflict in order to identify what sort of conflict it is. With that in mind, these six areas are likely the best pedagogical tool, as

they can be related to scenarios as well as the professional codes of conduct the learners will eventually be asked to operate under. Each of the various areas is explored here, providing discussion of underlying principles related to them. An example of each area can be found in the scenarios which are part of the survey instrument used in this study (Appendix A). Each scenario in the instrument used for this study corresponds in order with the conflict areas as they are presented here (i.e., the first scenario in the instrument corresponds with the first area of ethical conflict which follows).

The first area relates to contractual arrangements, and specifically to potential conflict dealing with professional obligations. Talking points in this area include: (a) it is wrong to exploit weaknesses in computer resources for personal gain; (b) programmers have a responsibility to design software according to specification (and users have a responsibility to provide adequate specifications); (c) accepted ethical principles are an implicit part of any contract; (d) programs are like any other personal property and should be returned to the rightful owner and paid for if used; (e) consultants must offer services which are in the best interest of their clients; and (f) it is unreasonable to expect software to be free from errors and/or deviations from the specifications (Parker, 1979).

The second area revolves around product rights. Talking points in this area include: (a) it is important to have clearly established guidelines regarding who owns software that has been developed, especially between universities and their professors who might develop software; (b) there is an important distinction between paying for the use of a

service and the mechanism for providing that service; (c) programmers generally do not have a property right to programs written for others if there is not a specific agreement which gives them this right; and (d) if someone seems uninterested in a product they have developed, this does not give others the right to appropriate that product (Parker, 1979).

The third area involves privacy and confidentiality of sensitive data. Talking points in this area include: (a) an apparent lack of a formal rule forbidding an unethical act is not an appropriate justification for committing it; (b) if a particular action to be taken is not illegal, individuals are responsible in determining how far to push their own principles; (c) there is an important distinction between the obtaining of information in computerized form and obtaining information by hand; (d) if a programmer wishes to use information, s/he should gain authorization to do so from the proper person; and (e) there is some information which by its very nature must be confidential (Parker, 1979).

The fourth area involves issues related to how personal values may come into conflict with the concept of organizational loyalty. Talking points in this area include: (a) failure to report unethical acts is, in and of itself, an unethical act (though it does not imply complicity); (b) if there is reason to suspect wrongdoing or harm, an act of omission may be considered unethical; (c) when technology is used to improve productivity, employers are obligated to consider the impacts on their workforce; (d) when negative consequences arise, a professional is only responsible for those things over which s/he has direct control; (e) those employed to do creative work should not undertake outside projects in

the same field without direct, explicit consent from their employer; and (f) professional societies need to make their codes of ethics available to their members as well as their member's employers (Parker, 1979).

The fifth area focuses on issues of liability (responsibility) surrounding the consequences (either unknown or controversial) of software products. Talking points in this area include: (a) humans are not to be treated as depersonalized objects; (b) scientists must do their best to ensure their products are being used in a socially responsible manner at all times; (c) ethical considerations need not restrict the conception/availability of inventions; (d) deception is always unethical; (e) safety for people goes beyond just meeting legal requirements in order to be totally ethical; (f) to some extent, the developer of a business application is responsible for providing adequate controls in the application to prevent (as much as possible) loss for a business due to use of the product; and (g) every participant in the development of software must consider human consequences at all times (Parker, 1979).

The sixth and final area involves the dissemination of information both to decision makers and the general public, and the overall responsibility for this information to be both complete and accurate. Talking points in this area include: (a) if an individual's work has been irresponsibly publicized and they do nothing about it, their action is unethical (particularly if they gain from it); (b) using popular applications and the notion of computer accuracy to lend false validity to information is unethical; (c) any proposal for a

computer system must include discussion of human factors involved; and (d) computers should not be presented as active agents (Parker, 1979).

It is worth noting that Parker (1979) suggests that many of the general principles which guide discussion in these areas of conflict are not necessarily "popular" with all computing practitioners. For example, in the area involving liability, some would object to the third point (that ethical considerations need not restrict the development of new inventions), while others would object to the sixth point (that developers are responsible to develop adequate controls to prevent loss). Both objections are legitimate concerns, but, as with any such discussion, it is important for these people to consider these items in the context of providing an overall framework from which practitioners may operate.

The areas suggested are rather broadly defined, and they are not mutually exclusive (e.g., contractual obligations, implicit or explicit, are of pivotal concern when discussing product rights). Also, at times it is difficult to cast a given situation into one of these areas, as the boundaries between them are not clearly defined. In the final analysis, the major goal of this Parker's (1979) work seems to be to provide a template which can be used to help computing practitioners identify potential ethical and professional conflicts. Used in conjunction with various codes of conduct, this material can ultimately help future computer practitioners cope with situations for which they might have otherwise been unprepared.

The ten commandments of computer ethics. At first glance, these guidelines may seem a bit humorous, what with the use of “good King James English,” complete with phrases like “thou shalt not.” Yet each of the commandments addresses potential issues to be encountered by the computing practitioner. The list was put together by the Computer Ethics Institute (1997), an important part of the Computer Professionals for Social Responsibility (CPSR). The commandments touch upon all six of Parker’s (1979) areas of conflict. Here, each of the commandments is addressed in terms of how it corresponds to the areas of ethical conflict.

The first commandment, “[t]hou shalt not use a computer to harm other people” (CEI, 1997) can be used in addressing conflicts arising in areas of privacy (Area 3), personal values (Area 4), liability (Area 5), and completeness and accuracy of information (Area 6). In each of these areas, human factors must be considered. In areas such as liability, for example, the harm may be more tangible as evidenced in the case of the Therac-25 (Spinello, 1997). In other areas, it may not be immediately evident that a computer is causing harm, yet the sharing of confidential information, the introduction of technology into the workplace, and even the reporting of inaccurate information may cause very real harm to individuals.

The second commandment is “[t]hou shalt not interfere with other people’s computer work” (CEI, 1997). It is not entirely clear to this researcher exactly how to relate this to one of the areas of ethical conflict. The key to solving this puzzle seems to be to

determine exactly what is meant by interfering in this context. The term is broad enough to include privacy issues (Area 3) and even product rights issues (Area 2). More likely, however, is the notion that Parker's work predates this work by almost 20 years, which means the idea of the computer virus simply did not exist (assuming that the virus is the ultimate form of computer interference).

The third commandment, "[t]hou shalt not snoop around in other people's computer files" (CEI, 1997), and the fourth commandment, "[t]hou shalt not use a computer to steal" (CEI, 1997), are related (as snooping will likely lead to stealing). These primarily involve privacy (Area 3) and product rights (Area 2) issues, though a case could be made for the meeting of contractual obligations (Area 1). This area probably has more far reaching concerns today than it did at the time of Parker's writing, since the advent of the Internet has made public access to a wide variety of information more possible than it was in the days of modems.

The fifth commandment, "[t]hou shalt not use a computer to bear false witness" (CEI, 1997), is practically a restatement of Area 6, dealing with the dissemination of complete and accurate information to the public. It is easy and tempting to take advantage of people's overall trust in the accuracy of computers, or to take advantage their distrust. Computing is still a human endeavor, from design to manufacturing, programming to use. Promoting computing as anything beyond this is a clear violation of this commandment.

The sixth commandment, “[t]hou shalt not copy or use proprietary software for which you have not paid” (CEI, 1997),” seventh commandment, “[t]hou shalt not use other people's computer resources without authorization or proper compensation” (CEI, 1997), and eighth commandment, “[t]hou shalt not appropriate other people's intellectual output” (CEI, 1997), revolve around product rights (Area 2) and contractual obligations (Area 1).

The ninth commandment, “[t]hou shalt think about the social consequences of the program you are writing or the system you are designing” (CEI, 1997), and the final commandment is “[t]hou shalt always use a computer in ways that insure consideration and respect for your fellow humans” (CEI, 1997) both deal with Area 5 (liability surrounding the consequences of software products). It is important, as Parker (1979) notes, for all those involved in the production of software to consider the consequences. However, personal values (Area 4) may come into play as well. In retrospect, these may well be the most difficult issues the computing practitioner faces.

The use of the phrase “thou shalt not” in the commandments gives them an overall notion of finality. Few of them leave any room for interpretation (merely having to think about the social consequences of software being the most notable exception to this). This researcher acknowledges that some will see this as a major problem, that learners will not have an opportunity to apply more situational forms of ethical analysis to scenarios. As to whether this is a strength or weakness is left as an exercise to the reader.

The ACM Code of Ethics. The ACM, as previously noted, has had a code of ethics since the early 1970s (Parker, 1979). The code has undergone significant revision, which is reflective of the dynamic nature of the field of computing. It is not the purpose of this study to explore a detailed analysis of the ACM code of ethics. Instead, the main points of the code will be summarized. The full code can be found in a variety of ACM publications (ACM, 1998).

Essentially, instead of telling practitioners what they should do, the *ACM Code of Ethics* tells them how they should act. ACM members are encouraged to be good citizens, to be good stewards, to be educators, and to be committed to quality in all phases of their professional lives. They are encouraged to uphold these ideals when in positions of leadership within their organization. Finally, the ACM member promises to comply fully with the code, and to “[t]reat violations of this Code as inconsistent with membership in the ACM” (Association for Computing Machinery, 1998). All of these are articulated as a set of 24 general imperatives.

There are two primary weaknesses in the code. First, as previously mentioned, the code lacks teeth. What happens to the ACM member who violates the code? According to the final imperative quoted above, they will be observed to be inconsistent. Exactly what this means is not clear. However, the language of the code reveals the other weakness which may be a cause for greater concern. There is an acknowledgement that language used in writing a code of ethics may be open to interpretation, and that it is even

possible for ethical principles to be in conflict with each other. However, the disturbing notion that “[q]uestions related to ethical conflicts can best be answered by *thoughtful consideration of fundamental principles, rather than reliance on detailed regulations*” [emphasis added] (Association for Computing Machinery, 1998), is most disturbing to this researcher. This is seen as a weakness because it calls for individuals to make judgments, rather than having in place a set policy.

All three of the frameworks herein can be used, and are probably best used in combination with each other. Parker’s (1979) areas of conflict can be used to identify areas of concern. It is important that, at the very least, computing practitioners be able to identify potential areas of concern. After the areas are identified, then the ACM Code of Ethics (Association for Computing Machinery, 1998) and/or the Ten Commandments for Computer Ethics (CEI, 1997) can be applied to help guide the learners (and eventually practitioners) to the best resolution for a given conflict. With these framework established, attention now turns to the various materials available for supporting instruction.

Supporting Materials

One of the earliest texts to be found in the general area of ethics (more correctly philosophy in this case) and computing is Crosson and Sayer (1967). They note that “. . . the possibility of artificially intelligent mechanisms will force some basic changes in our conception of intelligent behavior in the human being” (Crosson & Sayer, 1967, viii). In

some sense, until such mechanisms are found, computers and computing is still a very human endeavor. In other words, part of preparing undergraduates to use computers in an ethical and professional way is reminding them that computers are tools, albeit very powerful ones. Each of the texts considered here does this.

One of the more interesting approaches to ethics material is that taken up by Turkle (1984). Rather than taking the reader through a wide variety of case studies or narratives in the canon of fundamental ethical issues, the author instead leads them through a detailed observational study of the impact of computers on society. The author's basic commentaries center around: the impact of computers on children, the relationships between people and computers, and (ultimately) the embedding of the computer into culture. While probably not appropriate as the *only* text used in a computer ethics curriculum, it has the potential to be a very valuable supplemental vehicle and could even be used in a capstone course or a computer literacy course. Other texts that center more on the impact of the computer on society include Evan and Manion (2002), Perrolle (1987), Rosenberg (1992) and Schneiderman (2003). The focus of this study is more on purely computer ethics texts, though any of the aforementioned books would make a reasonable supplement.

Tavani (1996) considered a number of different characteristics in reviewing five more current computer ethics texts. One of the characteristics, style of book, is used to distinguish between a collection of case studies/anthology (which Tavani (1996) refers to

as a “reader”) and a more narrative style (or “text”). It is not clear that either of these styles is preferable to the others. Of the books reviewed by this researcher, Dejoie et al., (1991), Ermann et al., (1990), and Spinello (1997) would be classified as “readers,” and Bowyer (1996), Edgar (1997), Forester and Morrison (1994), Johnson (1984), Johnson and Snaper (1985), and Rosenberg (1992) would be “texts.”

Perhaps more important for this study than the “physical” characteristics of the books are the content areas covered in each. Tavani (1996) lists a number of important areas, including ethical theory, professional ethics, codes of conduct, computer crime, computer viruses, software piracy, intellectual property, artificial intelligence, computers and employment, computers and social power, computers and education, computers and gender, computers and politics, computers and quality of life, computers and privacy, security, reliability, liability, risks, health, civil liberties, networked society, and the future of computing. None of the texts reviewed by either Tavani (1996) or this researcher included all of these areas, though some were much more comprehensive than others. It is important to consider the intent of the course when deciding on a text (Tavani, 1996).

Guiding Studies

Two studies form the primary base from which this research is drawn. While they are relatively old, they also represent some of the most recent formal research in the area of ethics and professionalism in undergraduate computer science. Adair and Linderman

(1985) developed the survey that is the core of the data gathering instrument for this work. Parker (1979) devised a wide variety of scenarios that involve ethical and professional issues, six of which were modified for use in the data gathering instrument for this study.

The primary motivation for the Adair and Linderman (1985) study was born from the coverage that the issue of computer ethics had been receiving nationally at the time. They spent three years developing a survey instrument, focusing on questions of academic honesty. They divide academic honesty into 3 sub-categories: what is considered cheating, what ethical responsibilities do various parties have, and what sanctions are appropriate for suspected cheaters? They attempted to develop questions that would provide a means for differentiating between student attitudes. The result was the 23-item survey used in this study (Adair & Linderman, 1985).

The survey was administered to the 348 students taking undergraduate computer science courses at business school in the northeastern United States in the spring of 1984. There were 179 males and 167 females (evidently, two students did not provide gender information on the surveys). There were also 62 first-year, 28 second-year, 141 third-year, and 114 fourth-year students (it is unknown whether the remaining three students were non-degree seeking, or if they simply failed to provide information regarding their year in school). No attempt was made to randomly select a sample – the existing population was used in its entirety (Adair & Linderman, 1985).

The results of the original study can be broken into two general areas of interest for the purposes of this study. First, the instrument itself was divided into four subscales (general honesty, faculty responsibility, student responsibility, and necessity for action in clear cases of dishonesty), and also proved to be fairly reliable. Secondly, the results did show some general agreement among the subjects as well as differences between the genders and among the classifications. The researchers caution that some of the results obtained in their study reflect the fact that most of the third and fourth-year students would have been declared majors in computer science, where the rest may or may not have been (Adair & Linderman, 1985).

Specifically, there was general agreement that students need to report if a class is too difficult, that students who cheat are an affront to those who do not, that there should be strict penalties for repeat offenders, and that instructors and students have a responsibility to report obvious cases of dishonesty. In terms of classification, third and fourth year students were much more committed to instructors taking action against cheaters than the first and second year students were. In terms of gender, female students more strongly agreed that there was frequent cheating on lab assignments, that upper-class students have influence as role models, and that professionals had an ethical responsibility to report obvious cases of dishonesty. Males more strongly agreed that upper-class students should face stricter penalties for dishonesty than under-class students.

Adair and Linderman (1985) also admit to a secondary objective in the development and administration of this instrument. It was their hope that the subjects would recognize the importance of the topic addressed by the survey, and that (to some degree) they would recognize that there were indeed more or less correct answers to some of the questions. Thus, they believe that the survey results could serve as a jumping off point for student and faculty discussions about issues of academic honesty and how it ultimately relates to professionalism and work-place ethics (Adair & Linderman, 1985).

Parker's (1979) work arose from an entirely different set of circumstances. He echoes the sentiments of Gotterbarn (1998b), Martin (1998) and others that other professions and sciences have had centuries in which to "develop ethical concepts that form the basis for dealing with new issues" (Parker, 1979, p. 1). Codes of ethics in these areas are well-established, and are enforceable. It is his assertion that codes of ethics in computer science have been developed, but they have been developed without the supporting base of strong ethical standards (Parker, 1979).

Thus, the primary motivation of Parker's (1979) work was to begin to develop those standards. In essence, this was a Delphi study. A group of approximately 30 experts, consisting of not only leaders in the computing field but lawyers and ethicists as well, were asked to consider a set of one-page scenarios involving unethical practices that are relatively unique to and/or prevalent in computer science and technology. These experts were asked to: (a) write a short critique and position statement regarding each scenario,

(b) judge the appropriateness and value of each scenario, (c) add variations to the scenarios, and (d) suggest some additional scenarios. Those scenarios judged as “weak” by this panel were dropped, and new scenarios were added. The entire process was repeated, and this second set was used in a workshop (Parker, 1979).

The scenarios were to be written in such a way that they raised unethical rather than ethical issues. Minimal details were provided, and the language was as objective as possible. In other words, there was no clear bias toward the unethical acts presented in the scenarios. The participants voted on each person and what they did, and determined whether the particular person acted in an ethical, unethical, or non-ethical way. Each of the participants was allowed to write reflectively on their responses – supporting with opinion and/or fact, depending on the background of the participant and the nature of the scenario (Parker 1979).

As was previously mentioned, the study resulted in the identification of six areas of ethical conflict in computer science and technology. The major difficulty found in assessing the results of this work was in the attempt to find some level of consensus on each of the issues. The researcher posits that this inability to find consensus at least partly arises from the varying backgrounds and experiences of the participants in the study. Another source of difficulty is that the scenarios ultimately chosen were those which were clearly up for debate; scenarios which had a clearly unethical or illegal act were eliminated from consideration (Parker, 1979).

The researchers suggest that the scenarios collected and evaluated in the study do serve an important purpose – beyond the original intent of finding the fundamental ethical areas of concern in computer science and technology fields. They admit that the study is not (and should not be treated as) a treatise on computing ethics. Instead, it provides a basis for discussion. A learner or a practitioner can use these scenarios to develop a stronger ethical basis for themselves. To that end, an accompanying workbook was developed which can be used in educational settings at all levels (Parker, 1979).

CHAPTER 3

METHODOLOGY

The purpose of this study is to examine in some level of detail the attitudes that students have toward professionalism and ethics. The primary question that drives the study is an exploration of a possible relationship between academic honesty and professional ethics, in particular whether or not the subjects exhibit some consistency in their responses to similar questions in both areas. Other questions look at differences in attitude and understanding of ethics and professionalism between genders, age groups (traditional vs. non-traditional students) and experience levels (does having progressed farther through the curriculum provide better understanding?).

A pilot study of this research was conducted in the spring of 1999. Both lessons learned from the pilot study and the research questions that drive this study played a specific role in how the data gathering will be approached. Thanks to the experience gained through the pilot study, many difficulties regarding data gathering techniques were compensated for, and errors in the instrument corrected. Specific changes will be highlighted in any case where the methodology used in this study benefited directly from a difficulty or limitation encountered through conducting the pilot study.

The general methodology of this study is survey research. The instrument (described shortly) included demographic data, an attitudinal survey, and a set of reflective scenarios. Unlike strict survey research, both quantitative and qualitative methods of data analysis were used in this study. The primary motivation is the qualitative nature of the material

(how does one quantify ethics?), but another consideration was the parameters of the study itself. In essence, the relatively small (74 subjects) sample size afforded this researcher the opportunity to consider more quantitative techniques. Further, the limited population from which the sample was gathered also indicated that a qualitative approach was not only possible, but also appropriate. It is with the sample size that we begin the formal discussion of the methodology.

Subjects

In the spring 2003 semester, 170 surveys were sent to four institutions (which are referred to as A, B, C, and D). These institutions shared a number of common characteristics; all were small, private, church-affiliated liberal arts institutions located in small cities in the Midwest. Each of the institutions offered a computer science program that was well articulated with the recommendations of the current ACM curriculum (Engel & Shackelford, 2001). The institutions had similar facilities and drew their student population primarily from the state in which they were located. Two of the schools had programs directed at non-traditional age students, but only one of them offered a computer science option through this program.

Of the 170 surveys, 76 were returned (with 73 totally completed, 1 completed except for the demographic data, and 2 left blank). Throwing out the 2 totally incomplete surveys gives a return rate of approximately 44%, which is generally acceptable in survey research. It was stressed to potential subjects that participation in this study was strictly

voluntary and would have no impact on their academic standing (see the informed consent form in Appendix A). Anonymity of the participants was maintained by having them remove the informed consent form prior to turning in the survey to their departmental representative.

Each subject was asked to indicate the number of computer science courses s/he had completed and the number they were currently taking. These two numbers were added to compute the experience level for each of the subjects. After this computation was performed, there were 20 freshmen (0 to 3 courses), 20 sophomores (4 to 6 courses), 16 juniors (7 to 9 courses) and 16 seniors (10 or more courses), with one individual who provided no demographic data. This provides a split of 28%, 28%, 22%, and 22%, respectively. As a means of comparison, the subjects were also asked to self-report academic classification; there were 9 freshmen, 20 sophomores, 30 juniors, and 13 seniors. Of these, 41 changed "classes" when the experience levels were computed. The most common difference occurred among those who reported they were juniors but were actually sophomores by experience (there were 10 such subjects). Of some interest was the number of students who reported a classification lower than their experience level computed out to be, but this primarily indicated that they had completed their major courses as early as possible and put off their liberal arts core courses. In all cases, experience levels were relatively consistent with the age, especially for the traditional students.

The sample was fairly representative in terms of gender balance for undergraduate computer science programs. Of the 73 respondents who reported their gender, 46 were male and 27 female (a split of 63% to 37%). While this was a somewhat high proportion of females based on the work of Camp (2002), it falls within the range (26.7%-37.1%) reported for undergraduate CS programs between the 1980-81 and 1999-2000 academic years. It is also likely a reflection of the trend among these schools that shows an increased proportion of female students enrolling over the past five to six years.

In the sample, there were 61 traditional age students (84%) and 12 non-traditional age students (16%). It is not clear how representative this figure might be, but of the four institutions that participated only one had a significant non-traditional population in its CS programs. In general, it has been observed that this type of school (small, private, liberal arts) in this region has only recently begun to offer computer science programs tailored to the needs of non-traditional age students.

The other demographic data included: whether or not the subject had taken a course in ethics from a non-CS department, whether or not their department had its own ethics course that was required for all majors, whether or not they were currently employed in the computing field (only 20% of the subjects were), and whether or not they had transferred from a two-year college (only 9% of the subjects had). Institution C was the only school that had a required departmental ethics course for its majors, and only 5 of 23 (21%) had taken it. All four institutions provide the option of taking an ethics course

from philosophy or business as part of their general education program. Approximately 40% of the subjects have completed an ethics course in another department (29 out of 73). This number includes three at the institution with a departmental ethics course (all of whom also took the departmental course).

Data

The instrument used for data collection in this study has three parts: demographic data, an attitudinal survey, and a set of six scenarios similar to the one used to open Chapter 1 of this study. Demographic data regarding church affiliation and curriculum were also gathered from the (at that time) current college catalogs of the participating institutions. A complete version of the instrument used can be found in Appendix A.

Demographic Data

The original survey developed by Adair and Linderman (1985) asked only for student classification, gender, and major. The survey used in the pilot study added age. For this study, it was determined that major is no longer important, as the instrument would only be distributed to computer science majors. In addition, it was determined through the pilot study that the following demographic data would be of interest: (a) Have you taken an ethics course through some other department, such as business, philosophy, or religion; (b) Does your computer science department offer an ethics course? Is it required for the major? Have you taken it; (c) Have you transferred in from a community college or vocational technical school; (d) Are you currently employed in the computing

industry in some fashion; (e) How many computer science courses have you completed (not counting those you are currently taking); (f) How many computer science courses are you currently taking?

The first two additional questions were added on the assumption that those who had taken an ethics course (either from CS or some other department) might form different responses to the questions based on their (more or less) formal ethics training. The third question was added to attempt to compensate for a potential confounding variable; individuals who transfer to an institution that uses an integrated approach to teaching ethics may or may not have been exposed that approach used at their previous institution. The fourth question primarily figured to be primarily oriented toward nontraditional age subjects. Personal experience has shown this researcher that those who work in the field while pursuing the degree for purposes of advancement often have different attitudes toward learning than those who do not, and it was hypothesized that this difference would also be apparent in their attitudes toward ethical behavior. The last two questions allowed the researcher to form experience level categories, which were more useful than strict academic classifications.

The primary use of the demographic data was to place students into categories. Some of this data was specifically part of the research questions (in particular questions of gender, age, and courses taking or completed); the rest will be used to drive future research. It is worth noting that no particularly sensitive data was requested from

individuals, such as scores on standardized exams, grade point average, etc. The focus here was to create general categories: males vs. females, traditional age vs. non-traditional age, experience level, and those who have or have not had some sort of formal ethics course. It may be appropriate in a further study of the topic to consider intellectual ability as a determining factor of understanding ethical behavior in relation to computer science, but it was not a goal of this study.

Attitudinal Survey

The attitudinal survey survives basically in tact from the original version developed by Adair and Linderman (1985), and is shown in Appendix A. The survey was adapted by use of a wider likert scale (the original survey instrument used only a four-point scale, the updated version uses a seven-point scale) in order to increase reliability. Specifically, reliability is defined as “the consistency with which persons evidencing the same amount of whatever the test measures are assigned the same score under different testing conditions” (Krathwohl, 1993, p. 206), and in a Likert scale, increasing the number alternatives does increase this consistency. The main purpose of this survey was to explore each subject’s understanding of the relationship between academic ethics and professional ethics (or at least to ascertain if they believed such a relationship exists).

The survey items covered the following topical areas (Adair & Linderman, 1985): (a) the level to which cheating exists within the department (Items 1-4), (b) the level to which upper division students and faculty should provide leadership (Items 5-6), (c) the level to

which cheating is acceptable within the department (Items 7-13), and (d) the relationship between academic honesty (Items 15-16, 18-19, 21-22) and professional ethics (Items 14, 17, 20, and 23). The complete survey can be found in Appendix A; as necessary, the general theme of each individual item is discussed as they are referenced in the text of this study.

In the original study, Adair and Linderman (1985) were able to derive four subscales based on their initial results: (a) basic honesty (Items 7, 9-11, 13, 18, 20-21); (b) faculty responsibility (Items 15, 18, 20-22); (c) student responsibility (Items 14, 16, and 19); and (d) the need for action in cases of obvious dishonesty (Items 17-19). Differences on these four subscales proved to be of great interest when comparing the various groups: experience level, gender, and traditional vs. non-traditional age subjects (Adair & Linderman, 1985). Other than the expanded demographic data section and the expansion from a four-point to a seven-point Likert scale (discussed previously), the survey was distributed in its original form.

Reflective Scenarios

The survey concluded with six scenarios. Each scenario describes a setting from one of the six areas of ethical conflict identified by Parker (1979): contractual arrangements, product rights, privacy and confidentiality, personal values vs. organizational loyalty, liability, and dissemination of information. Each setting was followed with a listing of the various parties involved and the acts that they committed (which may or may not be of

questionable ethics). The subjects were asked to indicate whether each party acted ethically, unethically, or whether the issue at hand involved no ethical issue. This was a different approach than that taken by Parker (1979). In that study, the subjects were responsible for identifying the major parties participating in each scenario and any act(s) that each may have committed that would come under question. In this study, the acts and parties were explicitly identified; the subjects were simply asked to make a judgment as to whether or not each act was ethical, unethical, or involved no ethical issue, and then to justify their answers. This represented a shift of focus; rather than having the subjects identify everything, they were allowed to concentrate on the specific act and the people involved.

It is worth noting that Parker (1979) had specific ideas in mind regarding the ethical issues in each of the scenarios used here. He had presented the scenarios to a number of working computer professionals (as well as lawyers and ethicists) in order to obtain their best interpretation. The answers were ultimately arrived at through a consensus process. It was his assertion that the various acts were to be deemed as ethical or unethical for very specific reasons. The original teams were instructed to take the scenarios at face value; they were not to read anything into them. In analyzing the data, these absolutes must be taken into account to some extent. Thus the "correct" answers for each of the scenarios will be specifically reviewed Chapter 4 (Parker, 1979).

One difficulty that arose in the pilot study had to do with subjects labeling an act with more than one label. While this was likely even a goal of the Parker (1979) study, it was not necessarily sought after in this study; the primary pattern was that the subjects in the pilot study who marked more than one label were unable to adequately justify the labeling. As such, subjects in this study were specifically instructed to either take the scenarios at face value, or to indicate what (if any) assumptions they had made in coming to their conclusions. The scenarios were appropriately updated to reflect more modern technologies and settings, while still retaining their general meaning. By doing this, it was hoped that any confusion that may have been experienced by the subjects in the pilot regarding the scenarios would not be repeated.

Qualitative Data Analysis

Data analysis took place in two phases. The qualitative analysis of the narrative data from the scenarios started first, as it was deemed to be potentially the most time consuming portion of the analysis. This researcher and a colleague from the academic resources center at the same institution examined the narratives. To facilitate the evaluation of the writing, this researcher developed a numeric system to be used to rate the quality of the responses to each of the items. Table 1 illustrates the rubric used by both reviewers. The narratives were evaluated by three main criteria: (a) consistency, defined as the level to which the narrative corresponded to the labeling. In some cases in the pilot study, subjects labeled an act as unethical, but wrote about how ethical the act

was; (b) maturity, a subjective measure that focused on the words used and the content of the response. Within the pilot study, responses ranged from: "Duh! Call the police! He is a hacker with inside info" to a one-page response to the same question in which the subject cited a similar experience; and (c) understanding, defined as the subject's overall understanding of the situation. The goal here was to determine if a given subject demonstrated an understanding of the party and act s/he has been asked to evaluate.

A final concern was whether or not there even was a response. While nothing can be inferred from non-respondents, keeping track of them was deemed to be important. There were only 3 out of 74 subjects who wrote nothing for any of the scenarios. There was a single subject who wrote responses to the first two scenarios and not the last four, and two others who only responded to fifth scenario. As such, lack of response turned out to be a fairly innocuous issue in the qualitative evaluation.

Each reviewer evaluated the complete set of responses on his own. There was a demonstrable consistency between the reviewers in terms of the ratings. There were a total of 1332 ratings to be made (74 respondents, 6 scenarios each, 3 ratings each). Out of these, the reviewers differed by more than one rank on only 7% (93 out of 1332). Furthermore, the reviewers arrived at the same rank on 740 of the responses (a rate of 56%). This reviewer tended to be more generous in rating the writing. This can be attributed to the backgrounds of the reviewers; the other reviewer coordinates a writing competency program on campus and spends appreciable time evaluating student writing.

Table 1

Rubric Used in Evaluating Written Responses to the Scenarios

Category	Score	Interpretation
Consistency	1	Statement does not match rating of act at all
	2	Statement which mostly disagrees with rating of act
	3	Statement which mostly matches with rating of act
	4	Statement which agrees with rating of act, but is not terribly convincing
	5	Strong statement which matches rating of act as being ethical, unethical, or involving no ethics issue.
Maturity	1	Uses immature words, lacks sentence structure
	2	Uses technological jargon, lacks sentence structure
	3	Uses jargon or immature words, has some sentence structure
	4	Uses mature wording, lacks sentence structure
	5	Uses mature wording and proper sentence structure
Understanding	1	Statement shows no relationship to scenario, party, or act
	2	Statement mentions items from scenario, party, or act, but out of context
	3	Statement mentions items from scenario, party, or act, in context, but doesn't make sense
	4	Statement mentions items from scenario, party, or act, in context, makes sense, but is not convincing
	5	Statement convincingly mentions items from scenario, party, or act, in context, and supports rating

Those cases where there was a noticeable (more than a difference of one) level of disagreement between the reviewers were easily resolved. Upon completing the task, the reviewers met to discuss overall trends found in the writing. Through these discussions, it was agreed that this reviewer's ratings would be used in terms of consistency and maturity, while the other's ratings would be used in terms of overall writing quality.

Along with the ratings, the reviewers looked for overall trends in the content of the responses as well as those evidenced within the various groups (gender, age, and experience level). The final responsibility of the reviewers was to find responses worthy of direct quoting in the analysis and reporting of the data. As shall be shown in the analysis of the data, it was not necessarily always the highly rated responses that were quoted. There were a number of responses that were not highly ranked in terms of maturity that showed great consistency and/or understanding. Other responses were just too strange to pass up.

The primary role of the scenarios within this study was to give the learners more opportunity to express themselves outside of a tightly constrained instrument. In terms of grouping and interpreting the data, Parker's (1979) study (from which these scenarios were adapted) offers little help. The scenarios served a different purpose in this study than in the original (Parker, 1979). First, Parker did not provide the readers of the scenarios with any information beyond the narratives themselves. The readers had to determine what parties were involved, what acts had been committed. Second, the readers

were not asked to justify their choice regarding the ethicality of a given act until after the data had been gathered. Thus, the primary goal of Parker's study was to develop consistent interpretations of each of the scenarios, and to relate them to the six areas of ethical conflict.

The overall goal of the scenarios in this study was quite different. Instead of attempting to build a consistent interpretation of the issues, the subjects are provided with the acts committed and asked to determine their ethicality. It is the educated guess of this researcher that the responses on the two instruments will be fairly consistent in general, i.e., those who agree cheating is bad and that cheaters should be punished will likely recognize that the former manager in scenario two is cheating and therefore acting unethically. For example, in the pilot study, one non-traditional student wrote in response to scenario two, "Duh! Call the police, he broke the law. He is a hacker with 'inside' info." This same student responded strongly agree (or disagree where appropriate) to all of the items directly targeted at cheating.

Such consistency is not absolute. In another example from the second scenario in the pilot study, the non-traditional student who marked the former manager's action as ethical was not paying attention to what he circled when he went on to say, "he's breaking the professional code of computers. Just because he is capable of doing such he shouldn't until he was given permission to show them as an example." I suspect that it is not highly unlikely that someone will find some justification for the act of this individual

in the scenario, like the traditional female student in the pilot study who marked it as a non-issue and said, "This could be viewed as non-ethical because it was an illegal access. Yet, it could be ethical because it was put to good use."

This approach to gathering qualitative data is somewhat non-traditional, as there is no direct contact of any kind between the researcher and the subjects. As Harris (2002) points out, one has to look at the goal of the research to decide whether or not what is effectively a "correspondence" (the difference being that there will not be a direct response with these individuals) is a more effective technique than face-to-face interviews. This study in particular deals with a large number of participants, which renders face-to-face interviews highly impractical, but this is not the only reason to not do them.

When posing questions of a highly personal nature, a certain amount of invisibility is necessary for the subject to feel safe in expressing their answers. Great care was taken in this study to maintain this invisibility; the subjects submitted their responses to a third party. Unfortunately, this invisibility ends up being a detriment as well. As Harris (2002) notes, the biggest disadvantages appear to be immediacy. There is no way for the researcher to inquire about a particular response and get a timely answer and an inability to observe emotion. There is also the potential that respondents will not take the questions or their answers seriously. It is the opinion of Harris (2002) that these

weaknesses are outweighed by the benefit of safe expression. This notion was born out in the pilot study (Harris, 2002).

In coding the responses, Love (1994) suggests looking for several features of significance. In this study, the focus is on repetition, historicity (historical authenticity), and interpretations. In looking for repetition, we are interested in knowing whether or not the subject uses a similar theme in the responses to the six scenarios, as well as looking for common themes within the groups (gender, classification, and school type). In terms of historicity, the main item of focus is the impact of experience; those subjects who have had previous experience in the computing field may be likely to better be able to relate to the specific situation discussed in the individual scenarios, and the stories they tell to support or justify their responses will be significant. Finally, all of the responses require some level of interpretation on the part of the subjects. Are they reading something into the scenario that is not explicitly there? Do they leave anything out? These are important questions to answer (Love, 1994).

Some will ultimately question the legitimacy of using both qualitative and quantitative methods in this study. As Nau (1995) points out, "it is almost heretical in some institutions to suggest that quantitative research is a legitimate domain for understanding" (p. 1). There are likely just as many institutions where the opposite is felt, as seems evident in Streifling's (2000) editorial about the value of qualitative research, which seems at time apologetic. The bottom line, according to Nau (1995), is that the two methods can

and do complement each other, in a fashion similar to the way that psychological research and psychological therapy complement each other.

The important thing is to find a way to express the results of the qualitative analysis in the best light; the results should be persuasive in some way. As Smaling (2002) notes, there are basically three methods of persuasion that have been used in scientific (empirical) research in the past: persuasion based on the authority of the researcher (ethos), persuasion by an appeal to emotion or feelings (pathos), or persuasion based on reason (logos). Ultimately, if research is to be taken seriously, researchers must support their research logically; there should be some reason for arriving at the conclusion that can be supported through logical argument (Smaling, 2002).

However, the main obstacle that must be faced in qualitative research is not necessarily that of being able to support the conclusions logically. Rather, the researcher must avoid supporting his/her conclusions by dismissing the (quantitative) work of others. While this should not be an issue in this particular study, it is worth noting that this researcher is following Smaling's (2002) eight guidelines for supporting the arguments presented in this research. Of particular interest is the eighth point – avoiding fallacies. Essentially, it is important to account for as many threats as possible, and to not simply shift the quality (or lack thereof) of the results onto some other target, as if one were saying, my results weren't great, but they were better than this other researcher's (Smaling, 2002).

Finally comes the issue of generalizability. Smaling (2002) also suggests some ways to better support the generalizability of qualitative results. It is important to keep, as much as possible, these generalizations down to a case-by-case basis. It is suggested that the case being generalized should have a high degree of similarity to the original case, that the conclusions reached are relevant, that there is support out there (when possible) for similar cases and dissimilar cases, that the conclusion is reasonably plausible on its own, and that there might even be theoretical and empirical support. This last point provides yet another reason to use both quantitative and qualitative techniques (Smaling, 2002).

Quantitative Data Analysis

The second phase of the data analysis was essentially quantitative. This phase dealt primarily with statistical analysis of the responses to the survey data, and a variety of methods will be applied in this phase. Comparisons between two groups (e.g., male vs. female) typically used a t-test for means, and a chi-squared test for comparing the standard deviations. ANOVA, regression, and cluster analysis were used when making comparisons among several groups (e.g., the experience levels: freshman, sophomore, junior, and senior). Cross tabs were also used where appropriate, especially when general sample data sufficed.

In general, the research hypothesis in each area of the statistical research varied. For example, in determining the differences within the survey items among the four experience levels, it was hypothesized that groups would differ significantly, with seniors being at

the extreme high end of whatever scale is being used. This was generally attributed to the assumed maturity of these individuals, as they would have had the most experience in terms of specific course work in the major field as well as (potentially) more experience in terms of exposure to ethics material, either through its inclusion in the overall computer science curriculum, or through completion of a course, either as part of the major, as an elective, or as part of the general education program at their institution.

Similar reasoning was applied when considering the differences between traditional and non-traditional age students. The underlying assumption was that older students would have had more life experience, especially those who were employed in the field while completing their degree. The resulting assumption was that these subjects would generally tend to demonstrate a better understanding of professional ethics and ethical behavior. Finally, when comparing genders, it was hypothesized that there would not be a significant difference. Adair and Linderman (1985) found differences on only a small number of questions, and the pilot study turned up even fewer.

In all cases using quantitative analysis techniques, the 0.05 level of significance was used (results that were at a higher level of significance were noted). In cases using qualitative analysis techniques, what constituted a significant result was slightly more subjective. In considering the techniques used for each research question, we first review the research questions:

1. Are undergraduate computer science students aware of a relationship between academic honesty and professional ethics?
2. Is there a difference between traditional and non-traditional age college students in terms of attitude toward and understanding of professional ethics?
3. Is there a difference between males and females in terms of attitude toward and understanding of professional ethics?
4. Is there evidence that students gain increased awareness of the importance of ethics as their experience level increases (i.e., as they progress through the undergraduate curriculum)?

Research Question #1 (academic honesty and professionalism)

The hypothesis for this question is that students will be in general agreement regarding academic honesty. The attitudinal survey will be most heavily relied upon to address this question. The survey can be divided into three sections: items for which the mean score shows a general level of agreement (3-6, 9-19), items for which the mean score shows a general level of disagreement (1-2, 7-8), and items for which we would like the mean score to show agreement but are not sure (Items 13-32). Items 13-23 are the items that most directly impact this area. These items deal with the reporting of cheating, punishment, and the ultimate relationship between academic honesty and professionalism. In particular, Items 20-23 specifically mention professional ethics. The first 12 items on this survey also impact this question, but to a lesser extent. Items 1-5

on the survey mostly deal with the current state of affairs as the subject perceives them within their own department, 6-7 deal with instances where cheating could somehow be rationalized, 8-12 deal with the consequences of cheating.

While there was no direct writing by the subjects on this topic, the qualitative responses can still offer some support to answering this question. The reviewers looked for overall consistency of the responses and the labeling; this can be extended in analysis to consider whether or not there was consistency between the quantitative responses dealing with academic honesty and professional ethics and the qualitative responses (which deal entirely with professional ethics).

Research Question #2 (traditional vs. non-traditional)

It is hypothesized that nontraditional learners will have a more positive (or negative) response to survey items than will the traditional learners, based upon the expected response patterns in the previous discussion. At least one of the schools selected to participate in the study had a significant program targeted specifically at adult learners. The hope here was for representative balance, that the proportion of adult learners participating in the study would be as near as possible to the proportion of adult learners currently enrolled in computer science programs at various institutions in the United States. It is not clear that this goal was reached, as no specific literature on point could be found. Pearson (2000) does note that in general enrollment is increasing in adult learning programs, but does not mention CS in specific.

The written responses should provide a different dimension on this question. In general, it was expected that those who were working in the field (or who had significant life experience in general) at the time of the survey would also demonstrate a greater ability to correctly identify the ethicality of the acts. The underlying assumption was that these individuals would be better able to relate to the given situations, most often based on their own personal experiences. As to the general quality of the writing, it is not clear what the differences will be between older and younger students.

Research Question #3 (male vs. female)

Adair and Linderman (1985) found very little difference between male and female responses within the subscales and on the majority of survey items. Kreie and Cronan (1998) actually found several significant differences between male and female computing professionals on questions of ethics. They note that, "Men were less likely to consider behavior as unethical. Moreover, their own judgment was most often influenced by their personal values and one environmental cue – whether or not the action was legal" (Kreie & Cronan, 1998, p. 74). The key here is that the participants in this study were professionals. Thus, the hypothesis for this question is that the trend found by Adair and Linderman (1985) and in the pilot study will indeed continue; the female subjects' perceptions and attitudes toward ethics and professionalism are not significantly different from that of the male subjects (at least in terms of the survey instrument).

Based on Kreie and Cronan (1998) and the results in the pilot study, the scenarios are likely to prove to be more telling in terms of gender differences. The major difference in the two sections of the instrument is that in the scenarios the subjects are asked to make a judgment. One example from the pilot study where a very interesting difference between the males and females was found was in the first scenario. In this scenario, a computer center director notices that significant resources are being used for other than work purposes (playing games and other recreational activities) by researchers and notifies their research directors of the problem. The research directors tell the computer center director to mind her own business (see Appendix A for the complete narrative).

The female subjects were in complete agreement with regards to the ethicality of the acts of all three parties (the computer center director behaved ethically, the research directors and researchers unethically). The male subjects, on the other hand, were fairly evenly split where the research director and the researchers were concerned, meaning that there were males who labeled the acts of both as being unethical. This scenario involves misappropriation of computer resources to play games (and as such, it would be expected that even more males would label the acts of the researchers and research directors as ethical). Computer game play is an area traditionally thought to be all male, but this result seems to indicate otherwise (Klawe, 2002).

Research Question #4 (experience level)

The hypothesis is that there will be significant differences among the four classifications (experience levels), regardless of whether or not there was an ethics course of some kind taken prior to the survey. Adair and Linderman (1985) found significant differences among the classes in one sub-scale (regarding instructors taking action when cheating was discovered) and on a number of items. It is the contention of this researcher that students today are significantly different than they were 18 years ago when this survey was first run; personal experience shows that students are more likely to at least attempt to cheat and that they have a wider variety of options (thanks to ever-changing technology) available to them to make cheating more accessible. Thus, not only will there be differences, but it is hypothesized that they will be more significant than those found in 1985.

The qualitative results are likely to be less clear-cut. In terms of written responses, the basic supposition would be that the writing quality would improve as learners gain experience. However, computer science is not a traditionally writing-intensive program at most institutions, at least not in the traditional sense. CS students write a lot of programs, and these are things that require structure, but the structure is more strict than it is for reflective writing, and much less off the cuff. As such, while it may be that more experienced individuals are able to correctly label an act as ethical or unethical, it is not clear that they will be able to form any better (or worse) reflective responses.

CHAPTER 4

RESULTS

The results of this study are presented primarily according to the ordering of the research questions. In any case where institutional differences were apparent, the participating institutions will be referred to as Institution or College A, B, C, and D in an effort to maintain their anonymity. It is worth considering institutional return rate, as it has some impact on the results for a number of the survey items. Institutions A and B had the lowest rates of return among the four schools; only 7 out of 30 for Institution A (23%) and 8 out of 55 for Institution B (15%). Institutions C and D were higher, with return rates of 58% (23 of 40) and 80% (36 of 45) respectively.

The return rates from A and B were low primarily due to the academic calendar used at these institutions. Institution A uses a unique academic calendar, and as such it was difficult for instructors to contact all the students in the CS major as most of them were not taking CS courses at the time of the survey. The length of the academic term was the issue for students at Institution B. While classes were still going when the surveys were distributed at the other three schools, students at Institution B were preparing for finals. The due date for the survey was at the end of finals week. It is likely that this due date, in combination with the fact that majority of subjects to whom surveys were distributed at Institution B hold down full-time employment, lead to the low rate of return.

Overall Analysis – Survey Data

Once the data collection was complete, preliminary analysis showed that there were not sufficient numbers in different groups (e.g., gender, age groups, experience levels) to

consider differences between the colleges based on these groups. This is due to the low return rates from Colleges A and B. Thus, any differences between the colleges are dealt with only in this section on the overall analysis of the data collected. It is worth noting at this point that only two such differences were found.

Analysis of Individual Survey Items

Table 2 shows the mean and standard deviation for items on the attitudinal survey. In examining these results, it is important to recall the scale used to respond to the items, a continuum where a rank of 1 means strongly disagree, 3 means disagree somewhat, 4 means neither agree nor disagree, 5 means agree somewhat, and 7 means strongly agree. Thus, for any given item a mean score that is greater than or equal to 5 would indicate increasing levels of agreement, and a mean that is less than or equal to 3 would indicate increasing levels of disagreement.

There are more or less expected responses for each of the items, meaning that there is a desire that the subjects will tend to agree with certain statements and disagree with others. For example, on the first item, the subject is asked to gauge the amount of cheating s/he perceives on lab assignments in his/her department. The mean of 3.39 does indicate a certain amount of disagreement (i.e., the students do not perceive frequent cheating on lab assignments). The second item is similar to the first, this time addressing the issue of cheating within the subject's department on quizzes and exams, and that there is a desire for general disagreement with the statement. The mean of 1.78 implies that there is little to no observed cheating on departmental exams and quizzes at these

institutions. In fact, 68 out of 74 subjects (92%) responded with a rank of 3 (disagree somewhat) or lower. Exactly 50% of the subjects strongly disagreed.

Institutional differences. The issue of potential differences among the institutions is considered prior to examining the individual items. ANOVA tests were conducted on each of the survey items in order to determine if any differences existed among the four institutions. Table 3 shows the only two items for which these tests showed differences among the institutions, Items 1 and 18. On Item 1, which deals with cheating on lab assignments, a difference was observed between Institutions A and B (which had means of 2.14 and 2.63 respectively) and C and D (which had means of 3.57 and 3.69). First, there are nearly four times as many subjects from Institutions C and D, which at the very least means that there is a higher probability that some of them might have observed cheating. Second, 100% of the subjects from Institution B are non-traditional age. This generally means that they will have fewer opportunities to observe other students working on lab assignments, thus presenting them with fewer opportunities to observe cheating on such assignments.

The other item where differences were found among the institutions was Item 18, which addresses the issue of instructors having the responsibility to report cases of obvious dishonesty. In this case, the differences on the item were observed at a single institution (Institution C), and the difference was again confirmed using an ANOVA test. Out of seven total subjects who ranked this item with a score of 4 (neither agree nor disagree) or less (some level of disagreement), five came from Institution C (which accounts for 22% of the subjects from C).

Table 2

Descriptive Statistics for all Items on the Attitudinal Survey

Item	Mean Response	Standard Deviation	Minimum Response	Maximum Response
1	3.39	1.52	1	6
2	1.78	0.98	1	5
3	4.42	1.42	1	7
4	4.93	1.49	1	7
5	4.74	1.36	2	7
6	5.84	1.33	1	7
7	2.55	1.52	1	6
8	3.45	1.87	1	7
9	4.48	1.44	1	7
10	4.22	1.43	1	7
11	5.99	1.21	1	7
12	3.73	1.71	1	7
13	4.08	1.41	1	7
14	5.16	0.98	3	7
15	5.76	1.04	1	7
16	4.42	1.37	1	7
17	5.49	1.13	2	7
18	5.77	1.12	2	7
19	4.95	1.41	1	7
20	5.27	1.11	3	7
21	4.68	1.19	2	7
22	4.24	1.38	1	7
23	4.68	1.28	1	7

The result is a significantly lower mean response and a significantly higher standard deviation for that institution when compared to the others. From another perspective, nearly all of what could be considered outlier data comes from this single institution. In the case of both Items 1 and 18, the implication is that the factors leading to the differences between the institutions can be explained, and that the differences themselves are not of great significance.

Table 3

ANOVA Table for Institutional Differences on Items 1 and 18

Source of Variation	Sum of Squares	Degrees of Freedom	Mean Squares	F Test Statistic
<u>Item 1</u>				
Institution	19.61	3	6.53	3.09*
Error	148.00	70	2.12	---
Total	167.61	73	---	---
<u>Item 18</u>				
Institution	12.74	3	4.25	3.79*
Error	78.36	70	1.12	---
Total	91.10	73	---	---

*p < 0.05

Desired disagreement. There are four items on the survey where a general response of disagreement is expected or desired. As previously mentioned, there are Items 1 and 2,

which deal with observations regarding cheating. The other items are Items 7 and 8. On Item 7, the mean response of 2.55 indicates that subjects did disagree with the idea that cheating is justified if the course is too difficult. On Item 8, the assertion that cheating only hurts the cheater had a mean response of 3.45. In both cases, the mean response indicates general disagreement with the given statement.

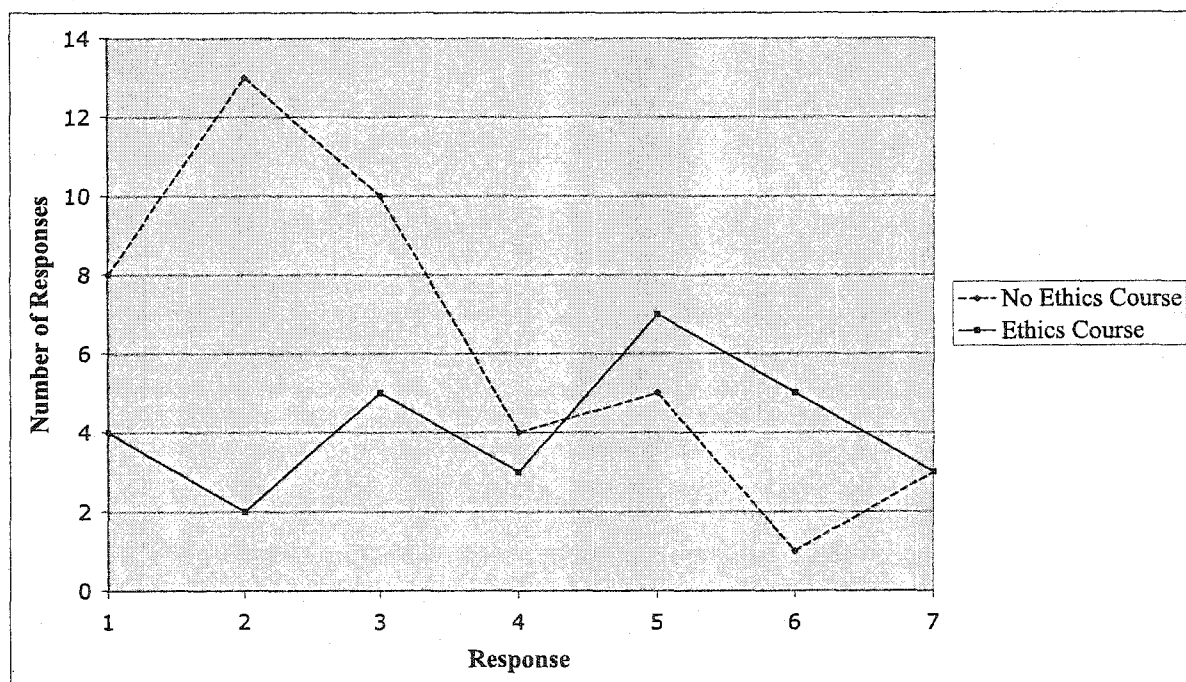
The veracity of the disagreement on Item 8 is uncertain. This is due to the fact that Item 8 has a standard deviation of 1.87; which is a fairly wide variation given a seven-point scale. In fact, Item 8 has the widest standard deviation of all the items in the survey (both overall and within in each institution). Out of the 74 subjects, 24 (32%) agreed that cheating only impacted the cheater (ranking the item from 5 to 7). Further exploration indicated that the source of the variation on this item was primarily those who had completed an ethics course, as is shown in Figure 1.

Desired agreement. Similarly, a pattern of agreement was expected or desired for Items 3-6 and 9-19 on the survey. These items can be categorized as: observation of cheating (Items 3 and 4), upperclassmen as role models (Item 5), reporting course difficulties to appropriate authorities (Item 6), cheating as an insult to hardworking students (Item 9), penalties and procedures for cheating (Items 10-13), and ethical responsibilities (Items 14-19). The general pattern of agreement (a mean response of at least 4.50) was found for all but six of these items. For those six items, the mean responses were all between 4.00 and 4.49 (essentially neither agree nor disagree).

For Items 9 (cheating is an insult to hardworking students) and 13 (individual instructors should invest resources in tracking down cheating), there are clear reasons for

the lower scores. In the case of Item 9, it is an experience level issue. Those classified as sophomores (4-6 courses) and juniors (7-9 courses) showed significantly lower agreement with the statement of Item 9 than did freshmen (0-3 courses) and seniors (10 or more courses). The results were confirmed by an ANOVA test. In the case of Item 13, gender was the prevailing issue with females showing a higher mean response and a narrower standard deviation (though both genders still fell in the neither agree nor disagree range).

Figure 1. Responses to Survey Item 8



Response curves for Item 8 (cheating only hurts the cheater and is otherwise a “victimless crime”), which shows a general pattern of disagreement among those who had not taken an ethics course and an inconsistent response pattern among those who had.

There are not obvious factors which contribute to the lower than expected means on the remaining four items. On the other hand, it is not clear that there necessarily should be. Perhaps there is more cheating observed among first and second year CS students (Item 3). In the cases of Items 10 (strict penalties for first-time cheaters), 12 (stricter penalties for upperclassmen who cheat), and 16 (students confronting their peers with dishonesty) the lack of agreement is not surprising. In especially these cases, agreement was probably much more desired than expected.

On the other items, one consistent pattern was observed. Those items relating to instructors and computing professionals tend to show stronger levels of agreement than those items relating specifically to students. This pattern is especially evident in the three sets of paired items. Items 14 and 17 deal with the responsibility of computer professionals to report cases of dishonesty and privately confront their peers. Items 15 and 18 express the same sentiment relative to instructors and their relationships with others in the department (including students). Items 16 and 19 follow similarly with respect to students and their relationship to their peers. In each case, the level of agreement was strongest for instructors, then for computing professions, and finally for students.

Items relating academic honesty and professionalism. There were no expected outcomes for the last four items on the survey (Items 20-23). The goal of these items is to assess the extent to which subjects are willing to equate academic honesty and professionalism. The results range from the relatively strong agreement (mean response of 5.27) with Item 20 (that academic dishonesty in the CS Department should be viewed

as a serious violation of Professional Ethics) to the neither agree nor disagree response (mean of 4.24) to Item 22 (the CS Department should devote more class time to address Professional Ethics throughout the curriculum).

The other two items both had mean responses of 4.68, representing a weak level of agreement. That there was any level of agreement in the case of Item 21 (the CS department should disqualify degree candidates in certain cases of academic dishonesty) was somewhat unexpected. To a lesser extent, the same is true of Item 23 (that upperclassmen in the CS major are already professionals with similar rights and responsibilities). However, both items exhibit the previously mentioned pattern; items that directly involve students have a weaker level of agreement than those involving professionals and/or instructors.

Subscale Analysis

Adair and Linderman (1985) identified four subscales within the survey, which they labeled as “general honesty, faculty responsibility to take action, student responsibility to take action, and necessity for action in cases of clear dishonesty” (Adair & Linderman, 1985, p. 94). The general honesty subscale consists of items dealing with the basic concepts of honesty: Item 7 (cheating is justified if a course is too difficult, Item 9 (cheating is an insult to hardworking students), Items 10-11 (dealing with penalties for cheating), Item 13 (instructors investing resources in pursuit of cheating), Item 18 (instructors reporting cases of obvious dishonesty), and Items 20-21 (how CS departments should handle cases of academic dishonesty). The faculty responsibility subscale consists of items directly related to faculty or departmental concerns: Items 15

and 18 (dealing with instructor responsibility for handling dishonesty) and Items 20-22 (departmental responses to dishonesty and integrating ethics into the curriculum). The student responsibility subscale consists of three items, Item 14 (computing professionals confronting their peers) and Items 16 and 19 (student responsibilities for dishonesty). The need for action subscale consists of Items 17-19, which deal with reporting dishonesty for professionals, instructors, and students respectively.

Table 4

Subscale Results for Attitudinal Survey

Subscale	Mean	Standard Deviation	Scaled Mean	Scaled Deviation
General Honesty	38.13	5.51	4.77	0.69
Faculty Responsibility	25.72	3.81	5.14	0.76
Student Responsibility	14.53	3.03	4.82	1.01
Need for Action	16.20	3.02	5.40	1.01

Note. Scaled mean and scaled standard deviations are computed by dividing the mean and standard deviation by the number of items making up the subscale.

In Table 4, the scaled mean and scaled deviation columns are an attempt to put the numbers in a similar range as the survey items to facilitate the assessment of their meaning. In the case of each subscale, the scaled mean is computed by dividing the subscale mean score by the number of items used to make the subscale (eight items for general honesty, five for faculty responsibility, and three each for student responsibility

and need for action). Given these results, it is noted that there is overall agreement on each of the subscales. In particular, the lowest levels of agreement occur on those subscales in which the student is a major factor. This result is consistent with the results reported on each of the individual items that make up the respective subscales (thus, the subscales provide a composite result of what has already been generally observed in the survey data).

Overall Responses – Scenario Data

After completing the attitudinal survey, subjects were asked to read and reflect upon six scenarios that involve some aspect of professional ethics in computing. Recall that the scenario data is broken into two parts. The first part, the proportion of subjects who labeled each of the given parties' acts as being ethical, unethical, or involving no ethics issue, is reported in Table 5. The second part involves analysis of the writing according to the criteria laid out in Chapter 3 (consistency, maturity, and understanding) as well as reporting general trends within the responses and overall quality of the responses. In the following discussions of the individual scenarios, many of the responses are quoted directly. Some are examples of patterns that evidenced themselves; others are just exceptional responses (either in a good or bad way). Additional data (age, experience level, and classification) on the subjects quoted can be found in Appendix B.

The written responses were evaluated using the process described in Chapter 3. As a measure of their overall quality, the responses fall into one of three basic categories: poor, acceptable, and excellent. Those in the poor category exhibited low ranks from both reviewers in terms of maturity, consistency, and understanding. In a similar fashion,

those in the excellent category showed consistently high ranks in terms of the same criteria. Those found to be acceptable exhibited either fair scores on all three criteria, or had high ranks in one or two of the criteria and low ranks in the other(s). In terms of this overall quality ranking, there was not a single pattern; responses to each scenario were of differing levels of quality. Table 6 shows the rankings of the responses by scenario.

Table 5

Proportion of Subjects Labeling of Acts Within the Scenarios

Scenario/Act	Ethical	No Ethics Issue	Unethical	No Response
Scenario #1				
Computer Center Director	76% ^a	14%	9%	1%
Research Directors	11%	28%	58% ^a	3%
Researchers	4%	28%	65% ^a	3%
Scenario #2				
Consultant	14%	8%	78% ^a	0%
Scenario #3				
Programmer	11%	20%	65% ^a	4%
Employer	7%	19%	73% ^a	1%
State Government	9%	38%	51% ^a	1%
Scenario #4				
Operations Manager	7%	9%	81% ^a	3%
Scenario #5				
AI Scientists	4%	34%	59% ^a	3%
Banks	8%	32%	55% ^a	4%
Scenario #6				
Systems Analyst	8%	20%	68% ^a	4%
Politician	8%	20%	68% ^a	4%

^a indicates the correct labeling of each act as set by Parker (1979).

Table 6

Proportions of Quality Rankings for Written Responses for Each Scenario

Scenario	Poor	Acceptable	Excellent
1	33%	39%	28%
2	24%	46%	30%
3	18%	51%	31%
4	19%	34%	47%
5	22%	57%	21%
6	36%	31%	33%

Note. The poor ranking includes those scenarios for which no response was written.

Scenario #1

The first scenario addresses Parker's (1979) first area of ethical conflict, dealing with contractual obligations. Specifically, it involves the misappropriation and misuse of computer resources (see Appendix A for the complete narrative). To summarize, researchers in a federal government computer center are using significant computer resources for game playing and other personal purposes. The director of the computer center notices this and brings it to the attention of the various research directors, who tell her it is none of her business. As is evident from Table 4, 76% of the subjects correctly indicated that the computer center director's act was ethical. In fact, the majority of subjects were able to correctly identify each act in this scenario, though as a group they were somewhat more forgiving of the research directors.

There was a variety of threads that consistently ran through the subjects' justifications of these acts. Among the most prominent were issues relating to money. A consistent theme among subjects who supported the computer center director in her actions was born out of a concern that *taxpayer money* was being misused; another was the potential loss of profits for the research firm. A few individuals specifically mentioned money, but put forth the idea that the issue was of no great consequence. Margaret noted that, "If the [research] director wants to waste the money in the budget to allow the researchers to play games, that is their choice."

Related to the idea of the money being wasted was the money being paid, even though this was not explicitly mentioned in the scenario. The prevailing sentiment here was that the researchers were not being paid to play games, but to do research. Issues of pay were generally cast in this way, but not in all cases. For example, Donna rated the computer center director's actions as involving no ethics issue and noted, "Why should she care? She's getting paid regardless."

Another common response related to the use of computer games and other activities for stress relief. The prevalent attitude was that a limited amount of such use is acceptable. The more pragmatic response was typified by Jackson who noted, "The research director is presumably responsible for getting the research accomplished. It's not clear from this context whether the game playing improved the researchers performance or degraded it, so it's difficult to make an ethical decision as an outside observer." Leon makes an even stronger point; he underlined the word *significant* in the narrative and noted that, "A small amount of use could be justified. But if the computer

department notices 'significant amounts' of time on computer being wasted, then they [the researchers] are acting poorly."

The issue of personal responsibility on the part of the researchers was another consistent theme. Typical responses that mentioned this idea used simple statements such as 'they should know better'; other responses were more eloquent. The research directors were typically targeted in these discussions. As Jeff pointed out in response to the research directors, "He's giving the researchers more freedom so they will try to do it more often and the projects will take longer which will, in turn, cost more money." About the researchers themselves, Jeff noted, "I think the researchers are doing it because they are allowed to. If they weren't allowed to, they wouldn't want to get fired." In fact, the research directors were often given a significant amount of slack, even in cases where their actions were labeled as being unethical. This sort of inconsistency in the responses was also a consistent theme.

As was the case with all but two of the scenarios, the largest proportion of the responses was deemed to be of acceptable quality (in this case, 39%). There were two typical patterns evidenced. Subjects would show fair rankings on all three criteria (maturity, consistency, and understanding), or (more rarely) they would have one very strong criterion and two relatively weak ones. In the case of these, there was not a single criterion that was typically weaker than any of the others.

Outside of Scenario 5, this scenario had the lowest proportion (28%) of excellent quality responses. Of these two stand out as having displayed thought that added the significance of the scenario. Maurice correctly points out, "Plus, persons there are using

the computer to make picture calendars which could be used to make a profit and thus be unethical.” This represents a clear conflict of interest. Donald noted that, “the [research] director should regulate the happenings within his/her department. He/she should make sure research is being done, especially if services are being charged to the research account.” Both of these are excellent responses because they display insight and thought; each goes beyond the standard response of ‘they should pay better attention’ by stating why this is the case.

While not representing any consistent theme, there are three responses that are worth considering for their poor quality. For example, it is not clear what Stephen had in mind when he noted that the computer center director’s action was unethical because, “if this is class-time, then it is not ethical as they should listen to their prof.” Ruth’s motivations were also unclear; she wrote that there was no ethics issue involved in the computer center director’s behavior because, “as long as they are doing illegal activities or observing porn it is o.k.” Finally, there is Melvin’s assessment of the computer center director’s behavior, “it was ethical, however, I would not have done that.” These are extreme examples of the poor quality responses to this scenario, which comprised 33% of the total responses.

Overall, the total response to this scenario was encouraging from a labeling point of view; 76% correctly identified the actions of the computer center director as being ethical, 58% correctly identified the actions of the research directors as being unethical, and 65% correctly identified the actions of the researchers as being unethical. However, the overall response was disappointing from a reflective point of view. Subjects seemed

to misread the scenario entirely, or to read into it a number of things that were inconsistent with the intent. The poor writing quality and the lack of internal consistency of the remarks to the labeling (i.e., the number of students who labeled an act as unethical and then proceeded to describe how ethical it was) are the two most significant.

Scenario #2

The second scenario addresses Parker's (1979) second area of ethical conflict, which involves product rights. Specifically, it brings up the issue of unauthorized access to resources. An individual quits his job and goes into business for himself as a consultant because it is his opinion that the company is not paying enough attention to potential security problems with their system. He offers his services to his former employer as a consultant, but his contract is refused. He uses his username and password to access his former employer's system, and then shows them how easy it was to compromise their system. This scenario was the only one to which every subject responded, seemingly because it is the most clear-cut in terms of ethical issues. A surprising number of subjects (14%) did label the consultant's act as being ethical, and their reasoning is somewhat creative yet also disturbing.

In fact, this scenario was fairly rich both in obvious patterns that emerged in the reading of the responses as well as some inappropriate responses. The potentially obvious response related to the company's own lack of professionalism. Subjects remarked that even though the act of the consultant was unethical, the company should not have left their former employee's password active. As Nancy put it, "I believe that this was an unethical thing to do...but had the company been smart, they would have kept

a record of who knew passwords and made sure that password had been changed to avoid a situation like this.” On the other side were subjects who held a firmer attitude; the company got what they deserved for being stupid enough to leave this back door open.

The second most common thread found among those who marked the actions of the consultant as being unethical was that of legality. A prototypical response comes from Warren who asks, “Isn’t that illegal?” Alice takes it a bit further, “I am surprised that this is not against the law! Totally unacceptable. Once you leave a job, you have no right to have access to protected information and data.” Maurice concurs, adding that “only time will tell if the only reason he accessed the data was to show them or did he have other intentions. No one will ever know.”

Another thread came through in the subjects who rationalized away the behavior of the consultant. These responses either laid the blame on the company entirely, or stated that the consultant’s motives were good; even going to the extent that what he had done would help the company in the long run. “The former manager did it for the purpose of revealing untight security, not for his own glory, or job back,” noted Rebecca, who marked the act as ethical. Brent also marked the actions of the consultant as ethical and noted that, “the consultant was not told he could not do this, so he did not violate ethics.”

Along these same lines was the notion that what the consultant did wasn’t wrong because it didn’t any particular skill. “That’s just plain wrong. There is no talent involved in breaching security if you have the key in your hands. If he would of honestly ‘hacked’ in with his vast knowledge of the network infrastructure, using his knowledge of what the server names were and where holes could be, he could be justified in telling

them, 'Hey, I broke in cause there are security flaws here and here,' he would have been okay. Anyone can find out basic info with enough probing to hack into a site. No one can protect from an inside job. That's just wrong," noted Leon.

The most overt justification of the consultant's act came from Jackson. He labeled the act as unethical, and began by deeming the consultant's act as nothing less than a criminal trespass. However, he also offered a potential rationalization for the act by saying, "If however the facility contained important private data or monetary accounts of third parties, the act may be ethical if it raises awareness of the third parties of the security problems sufficiently." In the same vein, Dirk called the act, "Questionable. If nobody lost privacy during these manipulations, then the manger had to do these. By showing holes to owner he just helped to fix problem."

The labeling results were very good, with 78% of subjects correctly identifying the act of the consultant as being unethical. The discussions also improved from the first scenario. Only 24% of the responses were rated as poor (with 46% rated as acceptable and 30% rated as excellent). In essence, this is likely due to the notion that there is a certain amount of romance involved with hacking, regardless of whether one believes it is ethical or not. There were, as stated previously, subjects who thought that the consultant had good intentions, but a significant proportion of them still labeled the act as unethical. While this is an issue of consistency between the labeling and the discussion, it is not a prevalent one.

This scenario had one particularly excellent response; it was on point and very well thought out. Donald marked the act as unethical and noted, "I assume that since the consultant was given a password, the entire system was password protected for authorized users. Thus, when the consultant left the facility, he should accept that he is no longer authorized. However, the facility manager should remove the consultant's password. Since the consultant used his password to extract data, he is not really showing the entire system is insecure. He is only showing that the system manager forgot to invalidate his password. The consultant should have notified the manager that his password was still effective, but not access the data. The consultant had no need to use his password after termination, so he shouldn't even have known his password still worked."

Scenario #3

The third scenario addresses Parker's (1979) third area of ethical conflict, privacy and confidentiality of data. Specifically, it addresses the issue of access to private data. In this scenario, a programmer that works for a marketing firm is also moonlighting, working on a contract for a state government. The programmer's employer notices that the data in the state government project would be of use to the marketing firm as well, and asks her to provide copies of it. There is nothing in the programmer's contract specifically preventing her from sharing the data in her contract, so she complies. In this case, the subjects correctly identify the acts of all three parties as being unethical. However, a significant proportion of the subjects indicated for each of the parties that there was no ethics issue involved.

The first note to make is that this scenario did not evidence as many seemingly off-task responses as the other scenarios. Of the few subjects that seemed to miss the point entirely that information needs to be private, the tendency was to make assumptions rather than make outrageous claims. In one example, Douglas marked only the programmer's actions as unethical. The employer had no ethics issue because it was "not ethics issue if it were ok'ed with the government study group," and that the state government's actions were "not an issue because participants knew what was going to be of the info." These are clearly assumptions that are no way part of the scenario.

The single most common thread in these responses was that the actions of at least one party in the scenario involved no ethics issue. In the case of the programmer, if there was mention of this not being an ethics issue it was because that her actions did not violate the letter of her contract, so she didn't really do anything wrong per se. Megan noted, "the employee was doing what she was told to do." Brent indicated, "whether or not the programmer complied w/the employer's request was up to her" (a response at the very least gives the employee free will, though the Brent still marked it as not involving an ethics issue).

If the employer was marked as having no ethics issue, it was either in the name of ignorance or arrogance. As an example of the former, we turn to Felicity, who marked the employer's action as involving no ethics issue and stated, "The employer probably didn't know the rights to the information. When told, they should have taken back this request." For an example of the latter, we turn to Dave, who marked the employer's action as *ethical* and noted, "The employee's contract with the government is the

employee's problem not the employer." This thread is best summed up by Paul, who marked the employer's action as ethical and says, "it didn't do anything wrong."

There were also subjects who felt that the state government did not have any ethical issue. Unfortunately, there is little to tell from this because the discussion points were typically inconsistent with the labeling. For example, Jason marked the government's actions as involving no ethics issue, but stated, "their decision it has no ethical issue unless talking about the childrens rights to privacy." Along the same lines is Grant, who noted, "it's not really their fault that someone handed it out and maybe they will punish that person." Paul also noted that there was no ethics issue for the government and stated, "the government has the right to divulge info."

Typical responses were much harder on the programmer than either of the other players in this scenario. Maurice noted that the actions of the programmer were unethical, and that they "should have been aware that the information was highly specific and should have been protected." Janet takes it a step further by stating, "Even without contract stipulations, this is obviously not her property to distribute." Grover noted that while everyone's actions were unethical, the actions of the state government were unethical because, "it put the programmer in a tough spot," but that the programmer behaved unethically as well, stating, "while it was not prohibited, it was unethical to give the employer the info." Alice said "[the programmer] should have gotten this approved by the state government first."

Some responses were highly inconsistent. As an example, Maurice correctly identified the employer's action as being unethical, and started off consistent with this

marking in his response. The employer, he noted, “has no right to information collected by their employee’s outside of their regular hours.” He then goes on to essentially invalidate his own argument, saying, “What an employee does on their own time is strictly their business unless it were to interfere with their employment. There was knowledge of and approval by her employer of her activities outside of her employment.” The problem with this response is that it ignores the use of the employer’s resources, which by default makes whatever work is being done using them the employer’s concern.

There were some very well constructed responses to all three parties in this scenario. Milton noted that the programmer’s act was unethical but, “Very difficult position for the programmer due to employer allowed use of resources. But the data does not belong to the employee. The programmer cannot give what is not his.” In the case of the employer, Angela said, “If the information contained personal data that was not expressly given consent by the owners [illegible part left out] then the data should not be released to other parties without proper consent.” Jackson thoroughly condemned the actions of the state government when he wrote, “it is the government’s responsibility to provide legal (and where possible, technical) enforcement of their intentions. Since the purpose was to develop statistical profiles, but the information was used for potentially abusive purpose[s], the government failed their duty.”

The best overall set of responses to this scenario came from Nancy. She marked all three parties’ actions as unethical and wrote mature, consistent comments that displayed a deep understanding. About the programmer, she noted, “the employee shouldn’t have done this because it is unethical to copy and give out anything...ESPECIALLY govt.

property or anything with specific info.” The employer’s action was a big problem for her as well, “why? They should have been ‘professional’ enough to not even ask, knowing that it would be unethical to get the information.” In response to the government’s actions, she wrote, “they should keep their documents/data under tight security, ESPECIALLY that of specific information such as this.”

The majority of respondents were able to identify the acts of each party correctly; 65% labeled the programmer’s act as unethical, 73% labeled the employer’s act as unethical, and 51% labeled the state government’s act as unethical. The writing quality also improved over the first two scenarios with only 18% of the responses being categorized as poor, 51% as acceptable, and 31% as excellent. This set of responses displays one of the best marks in terms of consistency of the labeling to the written response of all the scenarios.

Scenario #4

The fourth scenario addresses Parker’s (1979) fourth area of ethical conflict, that of the conflict between personal ethics vs. organizational loyalty. An operations manager discovers significant evidence that the top executives of his company are engaging in a massive fraud of their stockholders. He is often asked to do tasks or to make data runs that seem suspect to him. He chooses to just do the work and say nothing. When the fraud is eventually discovered and the executives are charged, he is deposed. He claims that is he is not expected to know the business end of the firm, and that he was just doing his job (the Nuremburg Defense). In this scenario, approximately 81% of the subjects

correctly identified this act as being unethical. This was the largest proportion to correctly identify an act in any of the scenarios.

The basic pattern that emerges in these writing is that inaction is bad; the failure of the consultant to act was his biggest downfall. Jackson even went so far as to take a utilitarian view when he noted, "his inaction resulted in harm to third parties." Brent took it one step further, "the fact that the manger failed to act on indications of company fraud is morally wrong." A number of other subjects were lead to recall the Enron scandal in 2002, such as Allan who noted "its fraud, kinda like Enron!"

The second most common thread was that not only was the act of the operations manager unethical, but he was also culpable. The argument was essentially that he aided in the fraud and should be fired or at least prosecuted. Tom noted, "the fact the company fraud was being done is unethical. If you are aware of it you are just as bad as the person committing it." Diana remarked, "this is definitely unethical. Ultimately no matter what the operations manager says to defend himself, he knew what was going on in the business and did nothing, therefore by doing this he was helping the company commit fraud. He also should have been prosecuted." Clint takes this further, "it's the operations managers job to watch out for company fraud. He should be fired."

The third most commonly expressed sentiment was that the operations manager was just looking out for himself. Whether or not he knew he was being ethical, the operations manager did what he did, as Paul put it, "save his own butt." Others justified the action as being unethical but understandable, such as Melvin who noted, "He should have reported the fraud, though it might have cost him his job and respect." Worthy of note is

the fact that this particular category of response (he was trying to save his job) did not occur nearly as often as it might have. From an anecdotal perspective, this researcher has noticed this is usually the response students come up with when discussing this issue in class. Even those that did talk about the possibility of the operations manager losing his job called the action unethical, such as Cindy who noted, "This is a difficult situation because many people, especially in a difficult economy would look the other way from such a situation. Fear of losing a job would come first."

Dave offered what both reviewers hoped was a tongue-in-cheek response. He noted that the action was unethical but, "instead of avoiding confrontation, he should exploit and blackmail the executives (they get paid too much anyway). He should have brought the unorthodox methods to someone-who-can-do-something-about-it's attention."

Adding what was the only seemingly off-task response was Peter, who stated that this was not an ethics issue because, "stuff is supposed to be private." These are the only two responses to this scenario that were out of the ordinary.

This was, in fact, the best scenario in terms of overall quality of response (47% of the responses were rated as excellent, another 34% as acceptable, and only 19% were poor).

The arguments were typically concise and clear, and the patterns that emerged in the writing were basically among those one might expect with this scenario, regardless of how the ethics of the issue was marked. While a number of very good responses have already been quoted here, perhaps the best comes from Milton. He stated, "The operations manager is weak. Another difficult situation to be in, but look at what trouble we have gotten into lately with this pleading of ignorance or 'I just did as I was told.'"

Nothing and no one is free from cause and effect. All are affected. His doing what he was told could very well have caused someone else to lose money, maybe even important retirement funds.”

Scenario #5

The fifth scenario addresses Parker's (1979) fifth area of ethical conflict, which looks at issues surrounding developers taking responsibility for the consequences of their software. In this case, a team of AI scientists has developed a speech-recognition and voice-response system that could be used to serve banking customers. They go to great lengths to convince people that they are talking to a person rather than to a machine. They are able to quickly market their invention, and no agency is able to study its effects prior to its widespread use. The banks also make no effort to let people know they are really talking to a machine and not a human. Both groups believe the consumers are responsible for the social implications of the device.

Based on the data, this scenario was the most difficult for the subjects to get a handle on. Even though the majority of subjects correctly labeled either the acts of the bank (55%) or AI scientists (59%) as being unethical, only 45% of them felt that both parties behaved unethically. Another 45% of the subjects fall in the category of thinking that one or both parties did not really have a clear ethical responsibility in this case. Of the remaining subjects, 9% felt that one party acted ethically and the other didn't, and 1% felt that both parties acted ethically.

Among those who correctly labeled either of the acts, the common thread was the fundamental notion that deception is wrong. Their responses are typified by Nancy, who

noted, “they [the AI scientists] knew there would be social implications, so they should have been ready to face them. It is unethical for them not to take responsibility for something they designed.” Milton noted that the banks were unethical because, “no business has a right or need to deceive, even if they call it competition or capitalism. Once again we run into that idea of anything for money.” Others took their cue from the narrative itself. Lincoln labeled both parties’ acts as unethical and noted, “the word deceives is used and that is my hint that is unethical.”

The main pattern found was a sense of what might be termed as *passionate indifference*; what happens in this scenario doesn’t matter and were simply unable to find a reason to be upset. In a real sense, it was though it was more bothersome to have to respond to this scenario at all. Common responses noted that ATMs are in use all over the country and it just shouldn’t matter. Clint marked the acts as involving no ethics issue and noted, “A robot teller will do it’s job better than a human teller. That’s my opinion.” Warren noted, “lots of things are invented that at least a small group of people are going to have a problem with.”

Inconsistent and seemingly off-task responses to this particular scenario were plentiful. Maurice noted that the AI scientists’ act did not involve any ethics issue, and his argument begins well enough. He started, “Just because you invent something doesn’t mean you intend to use it to deceive people,” but goes on to say, “[a] gun invented doesn’t kill people. It’s the person pulling the trigger that kills people. But they should inform banks in case of system failure to substitute a teller.” Perhaps the least coherent response to any of the six scenarios came from Tim, who labeled the banks’

action as ethical and noted that “in case if anything happens” as his justification. As a final example in this category, Milton started out just fine in noting to the AI scientists, “Yes, you do have responsibility!” but then goes on to recall that “a few guys in New Mexico devised a machine back in the 40s. They were aware of the implications and some worried about it. What excuses you from implications?”

In terms of responses, this scenario generated the least passion among the subjects. They were unable to discern the particular ethical issues involved. They focused in on their experience with similar technology (though such voice activated/response systems are at best fairly rare) or the *fact* that such deception is a regular business practice (some even felt that this was *acceptable* deception). This was the first scenario that brought up a significant number of ‘no comment’ type responses. Even though the writing 57% of the responses were rated as acceptable, the overall maturity of the writing was much lower than in any of other scenarios. In fact, this is the only one of the six where there was not at least one person to score a 5 in all three writing categories.

Scenario #6

The sixth and final scenario addresses Parker’s (1979) sixth area of ethical conflict, the dissemination of information to decision makers and the general public and the completeness and accuracy of that information. In this scenario, a systems analyst is asked to run simulations on a sociological model developed by a politician. The politician does not directly tell the analyst to make sure the simulations produce the desired conclusions, but leaves no doubt of what those outcomes should be. The analyst determines that he can get the desired results due to the fact that much of the data can be

easily manipulated. In this scenario, the same proportion (68%) of subjects found the acts of both parties (the systems analyst and the politician) to be unethical. Of some interest is the fact that a fair number (24%) of those who labeled one of the acts as being unethical did not label the other act as being unethical.

This is the only one of the scenarios where there is not strong evidence of a small number of obvious trends or patterns in the responses. The primary trend was based on the opinion that there is no surprise here because politicians are unethical on principle (at least to hear these subjects tell it). Perhaps the best example of this cynicism comes from Paul who quipped, "It is unethical but in politics who is to say?" Angela offers a somewhat toned-down version, "Actually all politicians lie to some degree. But changing data [something illegible] is fraud. Pure and simple."

The other pattern that evidences itself is the idea that deception is wrong. An example of a typical response of this type comes from Diana who noted in the case of the systems analyst that, "what [he] did was unethical. He deliberately made the results come out a certain way. This is basically lying and will also deceive a lot of people." In the case of the politician she noted, "[the politician] is definitely unethical. He basically maneuvers it so that the analyst knows what results to produce. The politician is basically altering important information and therefore deceiving people." Another typical response comes from Marvin who noted, "[the systems analyst] directly affected the outcome and did not simply generate the facts."

Another third trend was to let the programmer off the hook, either by labeling his act as ethical, or by justifying an unethical act. Grant noted that the action was unethical, but

“In his defense though he was asked to do it by a politician which made him feel important.” Milton was evidently not reading the scenario closely when he noted that the analyst’s act involved no ethics issue because, “The programmer is not in control of the sources of his data. His experimentation is interesting, but he should not fudge anything. Use the raw info and let the chips fall. I do not think he is responsible for producing data results the politician ‘wants.’” Kirk called the analyst’s actions ethical because, “If they are supplied with only the information they have then they are not negligent.”

While it was not an evident trend, there were those willing to let the politician off the hook. Peter noted that the politician’s act involved no ethics issue because, “he didn’t try to coerce the researcher.” Maurice takes it a step farther by saying, “just because he ‘desired’ results does not mean that the politician purposely made it a point to have his team forge the data. The information in this scenario did not give me any indication that the politician hinted about forging the experiment to suit his needs.” Jason echoes this sentiment, noting that, “He didn’t know for sure, but he did not instruct the analysis right. He was not aware of the wrongdoing by the analysis. He gave good analysis, just the top of the spectrum and not the bottom.” Perhaps the most interesting response was from Rebecca, who labeled the politician’s act as ethical and noted, “I think it was great for him to allow the systems analyst ‘freedom’ to do some improvisation.”

None of the aforementioned response patterns can really be called general trends. It may be that the only general trend was the off-task response. As an example we have Dawn, who failed to mark the analyst’s act as anything but noted that, “He should use his best guess on the data and not whatever guess is going to look best for the politician.”

There was also Josef, who believes everyone behaved ethically in this situation. He stated, “[the systems analyst] is doing his job making sure to get the right results,” and the politician, “wants the project to work right by assuring what he wants is okay.” Dean sees no ethics issue with either party. In this case, the analyst is “just trying to get experiment right if any scientist would,” while the politician “if assure the results and he gets them there is no problems he didn’t lie.”

Making statements like ‘it did not appear as though the politician tried to coerce the analyst’ lead the reviewers to believe that those who responded in this way missed the following key sentence in this scenario (see Appendix A for the complete text):

“Although he is too shrewd to instruct the analyst to force the study to desired conclusions, *he leaves no doubt as to the result he expects, and he makes much of the idea that the analyst is an important member of his team [emphasis added].*” While there were obvious instances of subjects reading things into the other scenarios, this scenario is the only one where they seemed to miss a very major point.

As the last few quoted responses show, there was some very poor writing (36% of the responses were labeled as poor, compared to only 31% being acceptable and 33% being excellent) in response to this scenario. As is evidenced in Table 5, this scenario had the largest proportion of poor writing of them all. Among the excellent responses, there were two exemplary sets worth noting. The first comes from Renee. The systems analyst is not only unethical in her analysis, but also unprincipled. She wrote, “It would appear to me that the only reason the analyst took the job was the paycheck. I cannot believe someone would waste his/her time and want his/her name on something that is so invalid.

I would think this could hurt the analyst's future positions if anyone found out that the results were skewed." But her commentary on the politician is more condemning. She asks, "Why go to the trouble of highering a staff to research something. The politician should have just made up a report with the results he wanted and saved himself some campaign money. There is no validity to anything anyway. It's obvious he didn't want accurate results."

The second excellent response comes from Donald. His assessment of the systems analyst is that "he has a direct part in a fraudulent act. Since he is hired for the job, he should do the job as requested, but with honesty. If the variables cannot be accurately determined, they should be reported as a range set. Instead, he alters the data as desired to fit his needs." "The politician," he noted, "is responsible for each of his constituents and is expected to be honest. Assuring results is lying to everybody involved or affected by the results. If the correct data does not fit his desired conclusions he should change his opinion or test more/other populations. It is fraudulent to alter data for his expected results."

Group Data Analysis

In analyzing the quantitative group data, two distinct approaches must be taken. The first is to simply look at differences between (or in the case of experience levels, among) the groups. It would be naïve to assume, however, that there were not differences due to multiple factors (e.g., age and gender). Therefore, appropriate techniques are used to explore the possible relationships between multiple factors. In terms of qualitative analysis, the task is somewhat more subjective. The coding used in the previous section

will provide some insight in terms of difference among the groups as well as serving as at least a basis for multi-factor analysis.

Gender

A t-test was applied to all 23 items on the attitudinal survey to determine if any differences existed between the responses of male and female subjects. Such differences were found on three items (1, 13, and 18 specifically). Recall that Item 1 relates to perceived cheating on lab assignments, Item 13 to the time that individual instructors should spend on prosecution of cheating incidents, and Item 18 to the instructors' responsibility to report cases of obvious dishonesty. The fact that there are not a remarkable number of differences between the genders on the attitudinal survey is consistent with the results found by Adair and Linderman (1985).

Figure 2 shows the distribution of ratings for males and females on Item 1. Note that the distribution for the male subjects is skewed to the left, where the distribution for female subjects is bi-modal. Further exploration shows that 100% of the females who responded to this item with a 5 (agree somewhat) or 6 (agree) came from Colleges C and D, which account for 81% of the females who participated in the study. Incidentally, 90% of the males who responded to this item with a 5 or 6 also came from Institutions C and D, which account for 79% of the males who participated in the study. Recall that this item was one of two on which there significant differences among the four institutions, and that these differences were found for Institutions C and D. As such, while the difference is of some statistical significance, it is likely not of significance in this study given the reasons cited earlier for the differences among the institutions. In essence, the

real result seems to be that there is agreement that there is a significant amount of cheating observed on lab assignments at schools C and D.

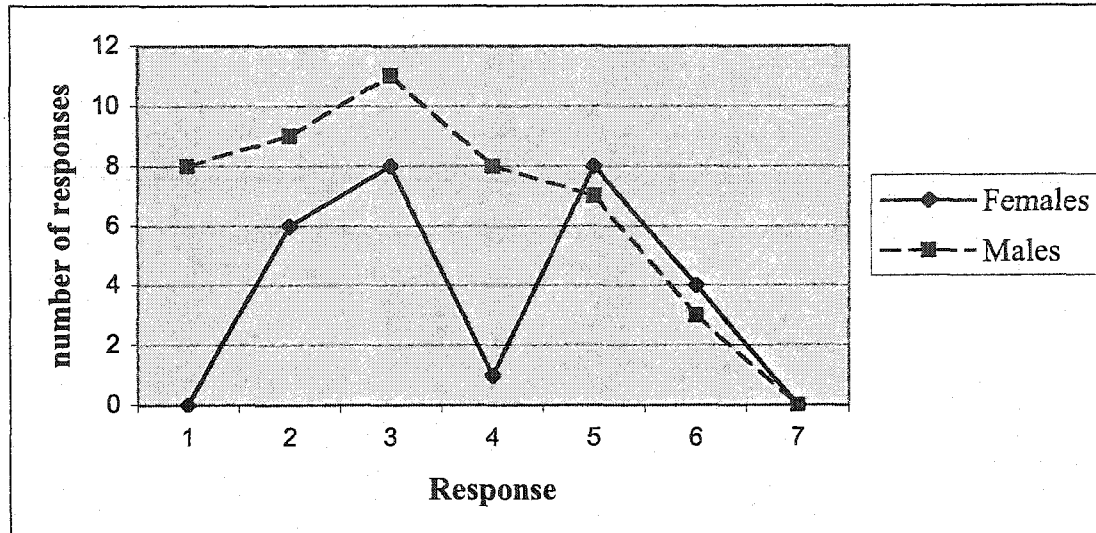
For Item 13 (instructors spending time and resources in pursuit of cheaters), it is again useful to compare the distributions between the two genders. As shown in Figure 3, the two distributions have essentially the same shape, and the difference between the two genders, while significant, is likely attributed to the difference in the size of the two samples and the existence of several outliers. There were eight individuals who responded strongly agree or agree to this item, and all are male.

In fact, the preceding patterns affect the differences between genders on Item 18 as well. This item (which asserts that instructors have to report obvious cases of dishonesty) is like Item 1 in that there were significant differences found among the institutions, and like Item 13 in that the bulk of the difference between the means can be primarily be explained by the difference in the sizes of the two groups and the existence of a significant number of outliers among the male subjects. As such, it can be stated that there are virtually no differences between males and females for the quantitative data collected via the attitudinal survey.

Recall that there are four subscales within the survey data: general honesty, student responsibility, faculty responsibility, and need for action. The only subscale on which there was a difference between male and female subjects on the student responsibility subscale. Recall that this scale is made up of Items 14, 16, and 19, all of which deal with the obligations of students (or professionals) in terms of reacting to cases of dishonesty. In the case of this subscale, females not only had a higher scaled mean (5.4) than males

(5.0), but a lower standard deviation (0.66 as opposed to 1.04). It is worth noting that these same differences did not show up on the individual items.

Figure 2. Male and Female Response Patterns to Item 1

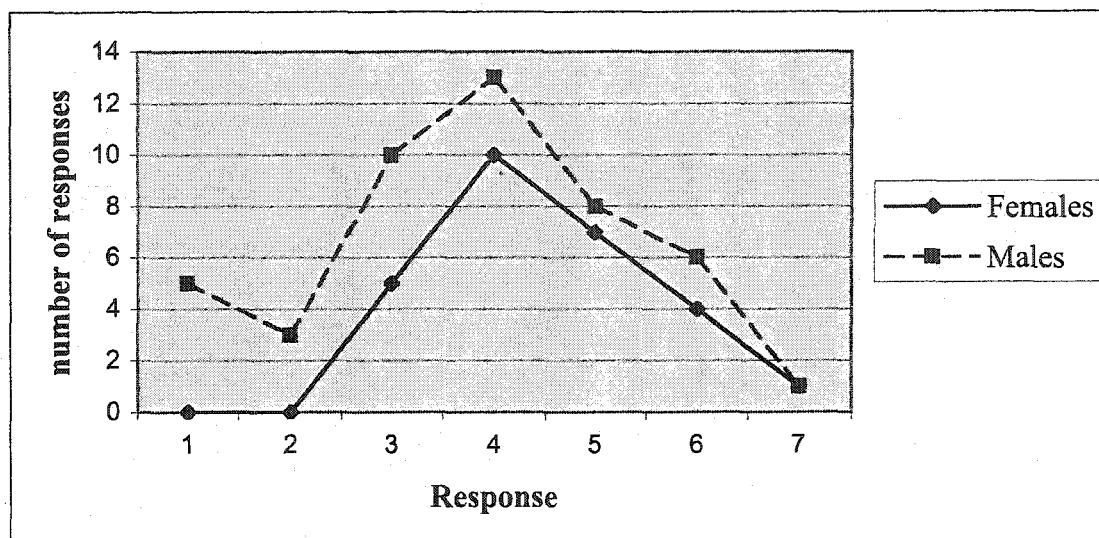


Note the basic shapes of the male (skewed left) and female (bi-modal) distributions. Nearly all of the female respondents in the right peak come from Institutions C and D. In this item, subjects are asked to signify their agreement with the statement that “Cheating frequently occurs on CS Department lab assignments.”

Table 7 shows the proportions of male and female subjects who marked each act as being ethical, unethical, or involving no ethics issue. The visual evidence alone shows that there are significant differences in the response patterns of males and females in terms of their correct labeling of the acts. Using the z-test for proportions, it was determined that there were significant differences between the two genders in the cases of the research directors and researchers (Scenario 1), the AI scientists and bankers

(Scenario 5), and the politician in Scenario 6. In each of these particular cases, the female subjects demonstrated a greater tendency to label the act correctly.

Figure 3. Male and Female Response Patterns to Item 13



Note the same basic shape for the two distributions. In this item, subjects are asked to signify their agreement with the statement "Individual instructors should invest time and resources to identify and prosecute cheating incidents."

The nature of the differences found is especially significant when considered in light of the overall results. Referring to Table 4, note that the research directors (Scenario 1), state government (Scenario 3), AI scientists, and banks (Scenario 5) were labeled correctly by less than 60% of the subjects. Further note that each of these parties' acts, as well as the acts of the researchers in Scenario 1, was labeled as no ethics issue by 28-34% of the subjects. In conjunction with the data from Table 6, there is a strong indication that the primary source leading to these lower percentage rankings is the male subjects. As for the programmer in Scenario 6 (who was correctly identified as behaving

unethically by 68% of all subjects), it appears that females were simply less willing to give him a break (at least in terms of their labeling).

Table 7

Proportions of Subjects Labeling Acts within the Scenarios, by Gender

Scenario/Act	Ethical		No Ethics Issue		Unethical	
	Male	Female	Male	Female	Male	Female
Scenario #1						
Computer Center Director	70%	85%	15%	11%	13%	4%
Research Directors	13%	7%	33%	22%	50%	70%*
Researchers	7%	0%	33%	22%	57%	78%*
Scenario #2						
Consultant	15%	11%	7%	11%	78%	78%
Scenario #3						
Programmer	7%	19%	22%	19%	65%	63%
Employer	7%	7%	17%	19%	74%	74%
State Government	15%	0%	33%	48%	50%	52%
Scenario #4						
Operations Manager	7%	7%	13%	4%	76%	89%
Scenario #5						
AI Scientists	4%	0%	46%	15%	46%	85%*
Banks	11%	4%	39%	28%	46%	85%*
Scenario #6						
Systems Analyst	9%	7%	20%	22%	65%	70%
Politician	9%	7%	26%	11%	59%	89%*

Note. Except for Scenario 5, all non-respondents were male. Recall that each of the parties was defined as having acted unethically by Parker (1979), except for that of the computer center director in Scenario 1.

* Significant differences were found between the two groups, $p < 0.05$

An examination of the written responses reveals other patterns. Females as a group ranked better than males across the board, in terms of the areas of coding used in evaluating the responses (consistency, maturity, and understanding). There were fewer confusing and/or nonsensical responses found among female subjects. Finally, the most dramatic differences in the response patterns and quality between the two genders are found in those areas where the males as a group were less able to correctly identify the ethicality of a given act (see Table 7).

In the first scenario, the males who marked the acts of the research directors (46%) and researchers (40%) as either being ethical or involve no ethics issue tended to mention either some benefit of game play (as either a stress relief or as a way to improve computing skills) or that there were not specific guidelines set forth saying that these things couldn't be done. As Jeff puts it, "I think the researchers are doing it because they are allowed to. If they weren't allowed to they wouldn't want to get fired." Melvin (who was previously quoted as saying that the computer center director's actions were ethical, but he wouldn't have done it) believes that the research directors have a different perspective on the game playing, "They view as a business decision, 'provided needed relaxing diversion.'"

Females, on the other hand, focused primarily on the issue of money, especially the fact that it was taxpayer money, being wasted. Those who did note that there were benefits to recreational use of the computing resources felt that charging this use to a research project which made use of public funds made it wrong. Alice, a 22-year-old junior from College A, states this best when she noted that the research directors are

“protecting the unethical behavior of the researchers. The research director has the power to stop this behavior.”

Males and females were very consistent in terms of their reactions to the second and third scenarios. The patterns that were exhibited in the overall data were proportionally represented in both groups in both scenarios. The primary difference that shows up tends to be the reasons that any of the acts were marked as ethical. For example, only male subjects brought up the idea that the only reason the consultant in Scenario 2 was behaving unethically was because he made use of the password (if he had broken the system by some other means, it would have been okay). Female respondents only slightly more often point out the good intentions of the consultant in Scenario 2 (but still label his actions as unethical). In Scenario 3, the reactions are very similar down the line, with almost every subject letting at least one of the parties (the employee, employer, or the state government) off the hook in some way.

In the fourth scenario, while there was not a significantly different number of females and males who correctly marked the act of the operations manager as unethical, there is a difference in the response pattern. Females, as a group, tended to focus on the harm that the operations manager did. The most passionate response of the group (for either gender) comes from Rebecca, who noted that “The operations manager didn’t *value, love, or respect* [emphasis added] the company and his co-workers enough to take action, and then lied about possibly having knowledge of the fraud later on.” Males tended to be a lot more pragmatic about the situation, often noting as Paul did that the operations

manager was just trying to “save his own butt” (even in cases where they still marked the act as unethical).

The most dramatic differences between male and female respondents occur in the fifth scenario. Female subjects brought up issues of trust and deception to a much greater extent than the male subjects did. While neither group mentioned the social responsibility of the AI scientists to a significant degree, females made more mention of it than males. In fact, males were more likely than not to indicate that they really did not think that this issue mattered. These patterns were especially true in the case of the AI scientists, where the most significant difference in terms of the labeling occurred.

In the final scenario, it is the politician who gets tougher treatment from the female subjects (the responses to the actions of the systems analyst are fairly consistent through both groups). The female responses to the act of the politician were fairly focused; they tended to state that it is wrong to manipulate data in order to deceive the public and that it was wrong to coerce the systems analyst into doing the dirty work. The male responses were all over the map. There were even a number of males who found no ethical problems with the action of either party.

As previously stated, the females in this study tended to have higher quality responses than the males as a whole. In point of fact, for nearly every scenario, the same numbers of excellent responses were found among the males and females. This, of course, means that females had a higher overall proportion of excellent responses. They also tended to have a higher proportion of acceptable responses than males. While the proportion of excellent responses among the females was never more than 10-15%, it was never more

than 4-6% for male subjects. On the other hand, there was also the same number of females as males who had no written responses (which again implies a higher proportion of females with no written responses), also the same 10-15%.

It is worth noting that the number of female non-respondents is inflated by what has to be the single most unexpected result in all of the data. Two 21-year-old female subjects from College D, failed to give no written responses to five of the six scenarios. The only one that either of them wrote anything on was in response to the banks in Scenario 5. Both of them marked the act as unethical, and *both* wrote, "If they know it deceives people." Further exploration revealed that they both marked every item on the attitudinal survey and every act in every scenario exactly the same, as well as the fact that all of their demographic information is exactly the same. While this hardly speaks for the character of a significant portion of the female subjects (or the subjects as a whole), it is at the very least ironic that two individuals may have chosen to *cheat on a survey that deals with academic honesty and professional ethics*.

Age Groups

In considering differences between traditional vs. non-traditional age, it is important to note that there is a considerable difference between the sizes of the two groups (61 and 12, respectively). On the attitudinal survey, a t-test for independent samples was applied for each item. Significant differences were found between the age groups on Items 7 (cheating is justified if a course is too difficult), 12 (penalties for cheating should be more strict for upperclassmen), 20 (academic dishonesty should be viewed as a violation of

professional ethics), and 21 (the CS department should consider disqualifying degree candidates for academic dishonesty).

The disparate sample sizes are the most likely explanation for all of the differences found. In the case of Item 7, non-traditional students disagree with the statement significantly more strongly than do traditional students. The primary reason for this difference is based on the fact that 18% of traditional age subjects agreed with this statement (another 16% neither agreed nor disagreed). There was only one non-traditional age subject who ranked this question higher than 3 (disagree somewhat), which makes up only 8% of their group.

The most significant difference ($p < 0.01$) found on the attitudinal survey between the age groups was on Item 12 (should penalties for cheating be stricter for upper-class CS students?). A substantial proportion of traditional age (43%) and non-traditional age (75%) subjects disagreed with this item at some level. The key area of difference is in the number of respondents who neither agreed nor disagreed (26% of traditional age subjects, 8% of non-traditional). Even though the difference here is highly significant ($p < 0.01$), it is not clear that this result should be given a great deal of credence. The overall distribution of responses to Item 12 was fairly normal. Given this and the fact that there are over four times as many traditional age subjects as non-traditional, it is unlikely that this difference is as significant as it seems.

In the case of Items 20 and 21, it is not as easy to set aside the significance of the results (except possibly due to the small sample size). In the case of Item 20 (academic dishonesty in the CS Department should be viewed as a serious violation of professional

ethics), 100% of the non-traditional subjects agreed at some level, while 28% of the traditional age subjects either chose to neither agree nor disagree or to disagree somewhat. Item 21 shows a similar response pattern. Given the fact that the majority (58%) of the non-traditional subjects were currently employed in the field of computing, these results seem fairly well supported. These two cases were the only ones in which current employment served as any kind of a factor.

In terms of the subscales, the only a-demonstrable difference between traditional and non-traditional age subjects was on the faculty responsibility subscale. This is likely due to the aforementioned differences between the two groups on survey Items 20 and 21, which are both part of this five-item subscale. This subscale difference does lend more weight to the significance of the differences between the two groups on Items 20 and 21. Current employment again served as a contributing factor.

The differences on the basis of the qualitative data between age groups are not as apparent when looking at the labeling of the acts. A z-test on proportions indicated only one significant difference (but at the 0.01 level) between the age groups, the operations manager from Scenario 4. In this case, a significant proportion of the non-traditional students were hesitant to call his failure to act unethical. As one might expect, the majority of the responses from the non-traditional subjects (especially those who were currently employed in the field) focused on the possibility that the operations manager would lose his job. Several of those who labeled the action as unethical indicated that he should have quit his job and then reported the fraud. In terms of writing patterns and response quality, it is difficult to make a general statement about the two groups. The

coding items (consistency, maturity, and understanding) tended to be more consistent among the non-traditional students, but the overall ratings tended to fall in the acceptable category. Essentially, this means that very few of the non-traditional students had consistently excellent responses. Subjects like Milton and Maurice (who were quoted extensively in the overall analysis of the scenario data) were exceptions within the non-traditional group, and even they were not consistent across all 6 scenarios. In some cases, it would have been nice to sit down with each of them and try to figure out what they were trying to say in some of their less consistent responses (such as Milton's comment about the guys in New Mexico who built a device in the 1940s).

Where the writing of the non-traditional students was consistent and average, the writing of the traditional age students was all over the map. The bulk of the strange, illegible, and unintelligible responses came from this group. It was also the case that all of the non-response items (those who did not label the acts as well as those who did not respond to their labeling) came from the non-traditional group as well. While a case could be made that the traditional age subjects as a whole took the task of completing the survey less seriously, it is not clear that it should be. The primary reason is that those traditional age subjects who did take the task seriously took it very seriously and produced very well thought-out and complete responses.

Experience Levels

Recall that the concept of the experience level is based on the number of computer science courses the subject has taken, rather than their reported academic standing.

Using this measure provides a better balance among the different levels (especially with

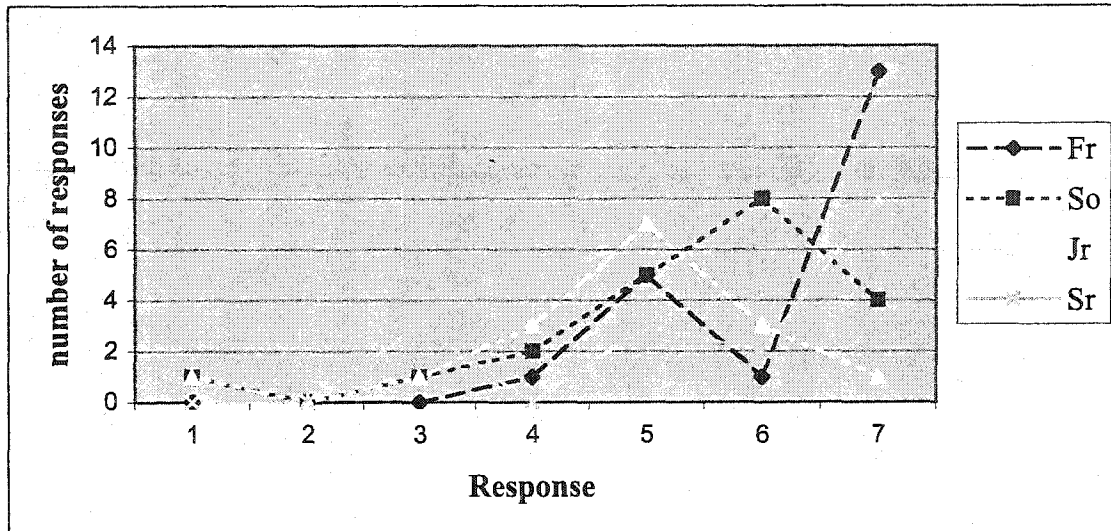
non-traditional students, who often take the bulk of their major courses early). It also produces groups that have a similar cognitive level of expertise with the subject matter in computer science. The experience levels are still labeled freshman, sophomore, junior, and senior; this allows us to have a commonly accessible frame of reference when talking about the different groups. In this sample, using this method, there are 20 freshmen, 21 sophomores, 16 juniors and 16 seniors (as opposed to 9, 20, 31, and 13 using reported class). While an ANOVA test found significant differences were found among the experience levels on six items on the attitudinal survey, the subsequent discussion shows that the differences are explained by factors the ANOVA test is unable to account for.

On Item 9, subjects are asked to consider the notion that cheating is an insult to the hardworking student who does not cheat. While juniors have a lower mean than the other three groups, they are not the main source of difference between the four, primarily because the standard deviation of the junior group is similar enough to the other three. Instead, freshmen are likely the main source of difference, with a higher mean and smaller standard deviation. Figure 4 shows a plot of the responses to Item 9 by experience group, and offers compelling visual evidence that the freshman group is the primary source of the difference.

Item 21, which states that the CS Department should review cases of academic dishonesty and potentially disqualify students from degree candidacy, is the second item we consider here. In this case, the fact that the junior group has a lower mean does imply that they are the source of the difference due to their significantly lower standard

deviation. As is seen in Figure 5, the shape of the curve for each class is basically the same; the junior curve is just to the left of the other three.

Figure 4. Experience Level Response Patterns to Item 9

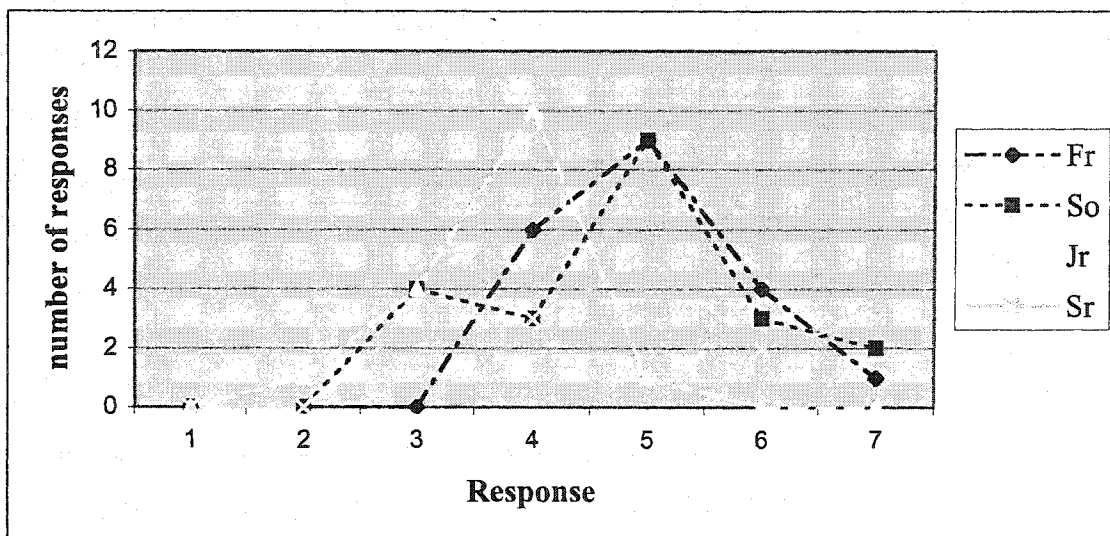


Note the difference in the shape of the freshman response curve, with a significantly higher proportion of subjects who strongly agree with the statement of Item 9. "Cheating is an insult to the hardworking student who does not cheat."

For Items 11, 17, and 18, the primary source of difference comes from groups that have outlier responses. On Item 11, subjects are asked to consider whether or not penalties should be stricter for repeat cheaters. In this case, the difference is primarily the result of the fact that the junior group is the only group who had any respondents that disagreed with this item at any level. On Item 17, there is a significant group of seniors (25%) that disagree at some level with the notion that computer professionals have an ethical responsibility to report cases of obvious dishonesty. On Item 18, juniors and seniors both have a small number of outliers (1 junior, 3 seniors) who disagree that instructors have an

ethical responsibility to report cases of obvious dishonesty. In each of these cases, the shapes of the four distributions are essentially the same except for the presence of the outlier data. As such, it is not clear that these differences are of any fundamental significance.

Figure 5. Experience Level Response Patterns to Item 21



Note that the junior curve is slightly to the left of the other three, but all have the same basic shape. Item 21 states that “The CS Department should review cases of academic dishonesty and should disqualify individuals from degree candidacy under certain circumstances.

The source of the differences among the groups is not clear on Item 20. Each group (except sophomores) had a number of respondents who disagreed with the statement that academic dishonesty should be viewed as a violation of professional ethics. The fact that the highest proportion of these is in the junior group initially leads us to believe that the difference lies there, but the senior group may also be a source. The seniors have a larger

standard deviation and smaller mean on this item than either the freshman or the sophomores. No other factors (ethics course, employment, age, institution, or gender) showed any significant contribution to the differences observed. At this point, it is worthy of note that the juniors seem to have an impact on these results for this particular sample, a pattern that will continue to evidence itself as the data analysis continues.

Table 8 shows the subscale scores for the four classes. A one-way ANOVA test showed significant differences among the groups only for the general honesty and need for action subscales. In the case of general honesty, the main source of variability is within the seniors. Seniors are also the source variability in the need for action subscale. It would appear to be the case that seniors vary fairly widely in their concept of general honesty, and show less of need for action. Also worth noting in Table 8 is the fact that for all but need for action, the junior group has the lowest mean score (and in the case of faculty responsibility the least deviation). This is in relative harmony with the overall data as well; there seems to be a consistent dip in most of the items when arriving at the junior experience level.

Figure 6 shows the trend in the ability to correctly label the acts in each of the scenarios. In considering the proportions at each level, there appear to be a lot of significant differences among the experience levels. Visual inspection of the data in this case will have to suffice; there is not a z-test for more than two proportions, and a chi-square is not indicated in this case for several reasons (chief of which is that it implies some knowledge of the expected number of responses).

Table 8

Subscale Scores for Experience Levels

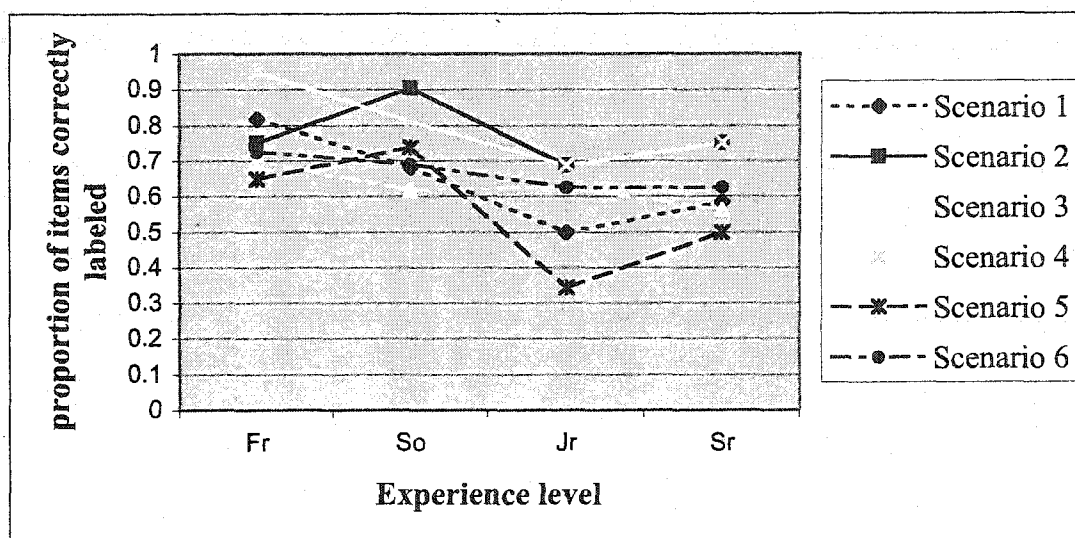
Subscale/Level	Mean	Standard Deviation
Faculty Responsibility		
Freshmen	26.55	3.43
Sophomores	25.95	3.67
Juniors	23.69	3.09
Seniors	25.94	4.39
General Honesty*		
Freshmen	39.90	4.84
Sophomores	38.05	4.51
Juniors	34.69	4.45
Seniors	39.06	7.08
Student Responsibility		
Freshmen	14.90	2.75
Sophomores	14.57	3.20
Juniors	13.94	2.35
Seniors	14.38	3.79
Need for Action*		
Freshmen	17.40	2.16
Sophomores	16.71	2.39
Juniors	15.25	2.49
Seniors	14.69	4.16

* significant differences were found among the groups $p < 0.05$

There is at least the appearance of a general trend among this data. Figure 6 is based on the average proportion of acts labeled correctly by each class in each scenario. As is evident from the figure, the proportion of correct labeling starts at a fairly high level among freshmen, declines slightly to sophomores, takes a large dip between the sophomore and juniors, and then rebounds a bit at the senior experience level (though in

all cases the proportion of seniors correctly labeling the items is will below the proportion of freshmen). Repeated z-tests among different pairs of the proportions bear this out. There are no significant differences between freshman and sophomores or juniors and seniors, but significant differences between most of the other pairs.

Figure 6. Trends in Scenario Labeling by Experience Level



Each point represents the average proportion of acts labeled correctly by each experience levels. Note the overall downward trend.

In evaluating the writing, this general trend continues. The freshman subjects display the greatest amount of maturity, consistency, and understanding in their responses to the scenarios. The trend works downward and hits bottom with the juniors and rebounds only slightly with the seniors. This is not to say that the best responses were crafted by the freshman. Rather, the responses of the freshmen are of the most even quality, none too wonderful and none too horrible. Primarily junior and senior students wrote the very

best responses, but as was the case when considering the traditional and non-traditional groups, few of the juniors or seniors were able to put together even quality responses to all six of the scenarios.

Impact of Demographic Data

Additional pieces of demographic data collected included information on employment (20% of the subjects held a job in the CS field at the time of the survey), having taken an ethics course (39% of the subjects had taken one) and whether or not the student was a transfer (9% of the subjects had transferred in a two-year degree). None of these factors had a significant impact on any of the survey items or the scenarios, with two exceptions. Taking an ethics course did have an impact on survey Item 8, though those who had taken the ethics course tended to agree more strongly that cheating only hurt the cheater. Current employment in the field of computing had an impact on the responses to Scenario 4, especially among non-traditional students (most of whom were currently employed).

This apparent lack of impact for factors such as employment and transfer is probably more due to the very small proportion of subjects affected by them. It stands to reason that employment would certainly have an impact on the survey items that refer to the ethical responsibilities of a professional. It is not clear at all that students who transfer would have any kind of impact, but is likely worth exploring in the future.

Of greatest interest is the apparent lack of impact of having taken an ethics course. Within the scenario data, there were no appreciable differences in the correct labeling of acts by those who had or had not completed an ethics course. While the writing was slightly better, the differences could hardly be labeled as significant. An equal number of

excellent responses came from both groups for all of the scenarios. Other than the one item on the survey, the ethics course made no difference. Even in that case, it appeared to have an “opposite” affect from the one intended by the question; one would certainly hope that students perceive cheating as affecting us all.

Interactions

Left to the last in the reporting of results is that of interactions among the major factors considered (gender, age, and experience). Taken together, the three factors do not produce groups of significant size to even consider the impact. There is only one each of non-traditional age female freshmen and juniors, for example. This leaves pairs of factors: gender and age, gender and experience level, age and experience level. Age and experience level have the same problem as the three factors combined. The same holds true for gender and age. The overwhelming difference in sizes between the traditional age male group (39) and non-traditional age males (5), along with a similar (though not as extreme) relationship between traditional and non-traditional age females (20 and 7, respectively) offer little hope for meaningful analysis between these pairs of factors as well.

In terms of gender and experience level, some effort was undertaken. While the groups are still not of equal or nearly equal size, the difference between them is not as dramatic as with the other pairs. Interaction plots were completed on all 23 survey items according to gender and experience level, and the only significant interactions that were found were on Items 1 and 2. Since these items specifically address the perception of cheating on lab assignments (Item 1) and exams and quizzes (Item 2), they are not of

significant interest for this study. With respect to the scenario data, the patterns that held for males and females overall held for males and females within each class. Thus, after all is said and done, there were no significant interactions found among the various factors that were considered in this study.

CHAPTER FIVE

CONCLUSIONS

This study is one of few undertaken in recent years that attempts to assess the ethical leanings and understandings of undergraduate computer science students. That being said, it should be stated from the outset that what is learned from this study can only be narrowly applied. Whatever the conclusions, they are primarily applicable to this sample. These same conclusions can certainly (especially in the cases of those schools with higher rates of return) be generalized to the institutions from which the sample was drawn, and at the very limit can be said to loosely apply to similar institutions. It is worth noting that this does not diminish the value of these conclusions, it simply sets reasonable boundaries upon them.

The conclusions are framed according to the four research questions which form the basis of the study. These are:

1. Are undergraduate computer science students aware of a relationship between academic honesty and professional ethics?
2. Is there a difference between traditional and non-traditional age college students in terms of attitude toward and understanding of professional ethics?
3. Is there a difference between males and females in terms of attitude toward and understanding of professional ethics?
4. Is there evidence that students gain increased awareness of the importance of ethics as their experience level increases (i.e., as they progress through the undergraduate curriculum)?

A number of worthwhile results fell somewhat outside the overall scope of these questions. Such results have value in the broad topic of ethics in the undergraduate computer science curriculum, and they will also be addressed (primarily in the section on possible directions for future research in this area).

Research Question #1

At first glance, the answer to this question is unclear. One possible way to evaluate the subjects' awareness of the relationship between academic honesty and professional ethics is the responses to Items 20-23 on the survey, which most directly relate the concepts of academic honesty and professional ethics. Through these questions, subjects are asked to consider whether or not academic honesty is a form of professional ethics within the context of undergraduate education. Admittedly, it was unclear exactly how the subjects would respond to these items. If a pattern of general agreement were found, this would support the idea that undergraduate computer science students do indeed make a cognitive link between their academic and professional experiences.

However, only Item 20 (academic dishonesty in the CS Department should be viewed as a serious violation of professional ethics) shows any noteworthy sense of agreement with a mean of over 5.0. The other items have a considerable number of detractors from among the sample, especially Item 22, which addresses whether or not the CS Department should devote more class time to professional ethics within the curriculum. From the point of view of these subjects, the answer is essentially "neither agree nor disagree." With Items 21 (disqualifying degree candidates for academic dishonesty) and 23 (upperclassmen are already computing professionals), there was a general sense of

agreement, albeit a fairly weak one (with a mean response closer to 4.5 than to 5.0).

More to the point, the junior and senior students who are most impacted by these items (especially 21 and 23) show a tendency to agree less strongly than the less experienced students.

Another indication comes from Items 14-19, which are paired items that address the responsibilities of computing professionals, instructors, and students. In all cases, the subjects basically grasp the ethical responsibilities of computing professionals and especially of instructors. They do not, however, tend to agree that they need to confront each other in any way (Item 16), nor do they agree very strongly that they need to even report cases to an appropriate authority (Item 19). This again provides some indication that while they perhaps see a need for professional ethics, they do not necessarily see themselves as professionals who need ethics. In particular, while there were no significant differences displayed, the mean response among the experience groups on Item 19 declines steadily from freshmen to seniors.

In fact, this separation of the concepts of academic honesty and professional ethics is indicated fairly strongly within various aspects of the survey items. One overall assessment of the survey can be drawn from the subscales (general honesty, faculty responsibility, student responsibility, and need for action). These results (see Table 4) essentially fell somewhere between the levels of "agree somewhat" and "neither agree nor disagree." Taken as a whole, this is the general assessment of the survey items. However, on both the survey and its subscales, items that were not directly student focused in some way (i.e., the survey items that deal with instructor and professional

responsibility [14, 15, 17, and 18] and the faculty responsibility subscale) had the highest level of agreement. Of those items that found strong agreement that did directly address student issues (Items 6 and 9), it is likely that the students were able to separate themselves from the items or to relate. In other words, they've probably had a class that was difficult, and certainly they believe cheating is not the answer (Item 6). The same is true for penalties for cheating (Item 9); it stands to reason that the penalties should be stricter for repeat offenders.

The subjects were able to correctly identify potentially ethical and unethical acts in professional situations. Though the writing used to reason about their identification of these acts was itself inconsistent and of average to below average quality most of the time, they were at least able to recognize acts at some level as being ethical or unethical. There were extremely few cases where the subjects indicated in any way that they were putting themselves into whatever situation. Scenario 4, the case with the operations manager who notices fraud, was one of two notable exceptions to this. Even in this case, there was not a preponderance of subjects who went to great lengths to try and identify with the operations manager; those who did thought mostly of themselves (i.e., I wouldn't do this because I'd be afraid to lose my job).

The other exception was Scenario 3, which dealt with the contract programmer that gave their regular employer access to sensitive data. But in this case, it was not that those who put themselves into the scenario were putting themselves into the role of one of the parties. Instead, those that tended to respond in a more personal matter did so because they did not like the idea that their (or their children's) privacy could somehow be

threatened. In any case, aside from these notable exceptions, the subjects were able to totally remove themselves; they exercised their ability to judge someone else's actions without having to make any kind of personal assessment.

In the final analysis, this is the key. If students are essentially unaware or indifferent of the impact of academic honesty, especially if they are unwilling to agree with items that might impact them personally, then it is not clear that they see any relationship between academic honesty and professional ethics. Further, if they have not had direct experience in applying ethical principles (which this study does not get to), it is unclear that they could possibly know that they need to. The fact that they can identify various acts as being ethical or unethical is immaterial, unless they are willing to somehow put themselves into this situation.

Research Question #2

Four survey items showed any significant differences, and two of those were easily explained away by the existence of outlier data and/or the small number of non-traditional age respondents. The other two items are part of that set of items at the end of the instrument that is intended to assess the subjects' ability to link academic honesty to professional ethics. These did prove to be worth consideration due to the significant amount of agreement that came from the non-traditional group. These items in turn had an impact on the faculty responsibility sub-scale, which also provided a significant difference between the two groups.

In the case of Item 20 (academic dishonesty should be viewed as a violation of professional ethics), not only was the mean higher for the non-traditional students (5.8 as

opposed to 5.1), but the standard deviation was less (0.8 as opposed to 1.1). This means that not only is there stronger agreement, but the agreement is more consistent. While the case is not the same for Item 21 (academic dishonesty potentially disqualifying individuals from earning their degree), in that the standard deviation among the non-traditional students is slightly higher (1.2 as opposed to 1.1), the difference between the mean responses (5.2 as opposed to 4.5) carries even greater meaning. Even though the means are both less, the non-traditional students still have a stronger level of agreement with the statement.

Even though there was not a lot of *statistically* significant evidence, it can be said that for the most part non-traditional subjects agreed more strongly on items where agreement was important (in particular on items related to student responsibility, the relationship between students and computing professionals, and departmental policy). The non-traditional students also tended to disagree more strongly on items where disagreement would be perceived as important. Item 19 (students reporting cases of obvious dishonesty) is a perfect example of the former case. While the p-value computed for this item was greater than 0.05, it was very close. That non-traditional students should agree that academic honesty should have a significant impact upon the CS department (Items 20 and 21) is a very important result.

As more and more non-traditional age learners are coming in to earn degrees in computer science, it is important that they have an impact (where at all possible) upon the traditional age learners. Even though the differences between the two groups on the scenario data were of limited significance, a very important example of the way that non-

traditional learners can contribute is evidenced. Notably, the non-traditional learners had more qualms about the ethicality of the act of the operations manager in scenario 4, but since the majority of them are employed in the field and the tech economy in particular is bad at the time of this writing, this result was not unexpected. What is important is that these learners be able to bring their life experience to the table, and those that participated in this study basically did.

Perhaps the most notable difference between the age groups was the quality of the writing. It is not the case that one group was somehow better than the other. Clearly, the most significant proportion of excellent responses came from the traditional age learners. But non-traditional learners were more consistent and thoughtful, and brought more of their own experience to the response when possible and appropriate. This must be balanced with the fact that there was a very low return rate from College B; it may be that they chose not to participate in the study because they did not wish to do so much writing.

In the final analysis, while the differences were not statistically significant, there was enough difference between traditional and non-traditional age subjects to be encouraged. That difference is primarily of understanding of professional ethics. The overall attitude, primarily evidenced in the survey responses, is basically the same. The notable exception is that the non-traditional subjects seemed to have a better handle on the relationship between academic honesty and professional ethics, as evidenced by their responses to Items 20 and 21. As stated previously, the most important difference is in the ability of the learner to put him- or her- self into a given situation. Non-traditional learners are

basically able to do this to a greater degree than traditional learners, primarily due to the fact that they come in to most any learning environment with greater life experience (Pearson, 2000). The largest shortcoming here is that the number of non-traditional subjects simply was not enough to provide an opportunity for a more authoritative conclusion.

Research Question #3

The differences found between the age groups within the survey items that were *statistically* significant were easily dismissed. This was primarily due to the difference in the sample sizes, though the institutions did have some effect. In particular, on Items 1 (perception of cheating on lab assignments) and 18 (instructors having a responsibility to report obvious cases of dishonesty), the differences between genders were almost entirely explained by the differences in the institutions. For Item 13 (instructors investing time/resources to pursue cheaters), the difference is entirely based on the sample size (see Figure 4). The difference between the gender groups on the student responsibility subscale is somewhat more encouraging. Still, its significance is based on what end up being fairly minor differences between the items that make up the scale, so its significance needs to be carefully considered.

It is in the scenario data, however, that the rich tapestry of differences between the genders can be found. Female subjects showed a very significant ability to correctly identify the ethicality of the given acts. There were zero applications of situational ethics in the written responses among the female subjects, and females as a group were more complete and consistent with their responses. Of particular importance, however, is the

ability of these female subjects to see an act as unethical when things are not necessarily black and white.

What this indicates is the ability for female subjects to put themselves in to the scenario. As a whole, their responses were less cynical throughout (even in scenario 6, where it was very easy to be cynical). Most important, however, is the clarity that the female subjects evidenced in their responses. The majority of them were able to communicate their understanding, from a personal level, without getting too involved in the issues. While it would be difficult to say this with great authority, there is the impression that either they are able to separate their "personal" ethics from these "public" situations or they have a good handle on what is and what is not ethical.

The male subjects, on the other hand, tended to be more crude in their responses. They often resorted to cynicism and/or sarcasm, their writing tended to be choppy, and there were a number of highly off-task responses. There were certainly exceptions to this (as there were for the female respondents), but as a whole this pattern was the norm. If a given item was not black and white, as in scenarios 1 and 5, the males had a more difficult time identifying unethical acts. Whether this is an indication that males are less able than females to deal with potential shades of gray is unclear. It may simply be the case that males are less willing to state their opinions on such matters.

What is clear from much of the literature is that there needs to be a more black and white approach to ethics education in computer science (Engel & Shackelford, 2001; Spinello, 1997). As such, it is not necessarily the case that the male subjects had a difficulty with gray issues; maybe in the end they were simply unable to see the black and

white nature. Whatever the case, the bottom line is that with this sample and for this limited subset of scenarios, female subjects were better able to respond correctly and to more completely communicate their understanding. The fact that two female students may have cheated on the survey should not detract from this (regardless of how amusing it may be).

Thus, the bottom line is that there is a difference between the genders (where this researcher initially did not think there would be one). Certainly the data on attitude (from the survey) did not show any deeply significant differences (after accounting for other factors), which at some level leads to the conclusion that both genders have the same basic attitude. Other studies (Whitley, 1996) lend some credence to this idea; he suggests that the perceived gender gap in computing may not be as wide as it is portrayed to be, with no difference at in terms of attitude towards computers and their social impact (Whitley, 1996).

On the other hand, this may not be the case. For potential evidence, consider that the female subjects did have a much higher score on the student responsibility subscale (and a lower standard deviation), which indicates that they do have an appreciation for their responsibilities as students. But in terms of understanding, there is no contest. Female subjects did display a significantly better, perhaps even deeper, understanding of professional ethics. More importantly, the female subjects displayed a better facility for applying those general ethical principles related to computing. Whether or not they have had direct instruction on applying such principles is not clear from the data collected.

Research Question #4

The initial answer to this question is no; the data gathered and the results produced provide evidence to the contrary. Among these subjects, it appears that the attitude toward and understanding of ethics lessens as experience increases. Why should juniors be more opposed to being disqualified from degree candidacy for academic dishonesty than seniors (Item 21)? Why should this same group significantly disagree with Item 9; that cheating is an insult to the non-cheater (where the other three do not)? It seems to make some sense that juniors and seniors would be of the same mind that academic dishonesty somehow equates to a violation of professional ethics (Item 20). Yet they are less consistent in their answer to this question (and agree less strongly) than sophomores and freshmen. Given that there were no other contributing factors to explain these results, it is not clear why these patterns arose. Clearly, it has something to do with these subjects, and perhaps the environments at the participating institutions.

The pattern evidenced in Figure 7 (the ability to correctly identify the ethicality of an act diminishes as the subjects gain more experience) is extremely curious. The implication seems to be that freshmen are more able to correctly identify the ethicality of an act than seniors are. In the majority of situations used, the difference was highly significant. The first possible source of explanation comes in the form of having taken an ethics course, but nothing comes of it; it simply is not a factor in this case because the numbers that have taken such a course are fairly evenly spread through the curriculum.

A second potential explanation of this phenomenon, and one that was not controlled for in this study, is the concept of *senioritis*. Essentially, this is a just a label for a

“condition” in which seniors take their work less seriously, especially during the final semester. While there are no formal studies on this phenomenon known to this researcher, there is little doubt as to the existence of the condition. In this study, given the quality of the written responses, there is at least the potential that this is a factor. Future replications of this work will have to include some control for this factor, as its impact may be widespread. There is no honest way to determine whether or not it is a factor in this study.

There are other possible explanations for the pattern evidenced in the written responses (in that they seem to get worse among more experienced subjects). In most undergraduate settings, freshmen are taking or have more recently taken a basic writing course. Since there is not a great deal of writing that takes place in a traditional computer science curriculum, perhaps it stands to reason that the freshman subjects wrote better responses. Their skills have had less time to deteriorate. On the other hand, in private liberal arts institutions like the ones participating in this study, significant amounts of writing will take place in other courses, so it is not clear whether or not this explanation has any merit.

What is clear is that there are definitely differences between experience levels in terms of their understanding of professional ethics. That it is freshmen and sophomores that have the better understanding than juniors and seniors is truly a mystery. There is also a difference in attitude, and it too gets worse over time. Perhaps there is an anxiousness of upper-division students to “get out there and ‘do’ computer science” instead of sitting around and talking about it. Perhaps the junior and senior groups in this study are from

the last vestiges of the “me” generation. This result is clearly the exact opposite of what was expected, and this researcher can only offer speculation as to its source.

Overall Assessment

Some aspects of this study are very encouraging and others are not. The most encouraging is the differences between males and females. Computer science has long been viewed as a predominantly male discipline (Klawe, 2002; Whitley, 1996). While this result may not change this attitude; it is encouraging in the sense that it shows that there may be aspects of computer science of which female learners have a better understanding. If such a result leads to more honorable female students selecting to major in computer science then this would be a very good thing indeed.

The fact that some differences were also found between traditional and non-traditional learners is also encouraging. In many areas of the country, adults are going back to school to pursue a second (sometimes a first) education. While this sample was hardly representative, it is good to note that there is a difference between the two groups in terms of attitude and respect. The challenge will be for curriculum designers, text book writers, and ultimately instructors to develop materials which best address the needs and skills that adult learners bring to the computer science classroom (especially those with significant experience who are coming in to get their knowledge updated). In terms of ethics in the curriculum, this is perhaps most important as non-traditional learners can (and seem to be willing to) offer relevant insight through their own experience.

Aside from the inexplicable results in terms of experience level and an overall sense of indifference gathered from the survey data, there are a number of other results arising

from this study. Clearly, a larger sample would have offered more opportunities to explore interactions between the various factors, as well as the possibility of a larger set of non-traditional age learners. However, the single most disappointing result had to do with ethics course, of both the general education and CS department variety. In terms of the latter, there simply were not enough students who had taken a specific CS ethics course (only 5 total respondents) to even consider including it as a factor.

The fact that having taken an ethics course in another department had no effect was not entirely unexpected. This may indicate any number of things. Ethics being taught in a vacuum is chief among them. Several have argued in the literature (Gotterbarn, 1998a; Gotterbarn, 1998b; Martin 1998) that in order for this material to make a difference to computer science students, it has to be applied in some way. It could certainly be argued that undergraduate ethics courses focus on ethical theory more than they do practice. This is not a criticism, but an observation.

Another possible indication is that the subjects may have taken a more applied ethics course (especially a departmental course), but simply were too far removed from the material to remember it or recall how to apply it. Much the same argument was previously made in the discussion of the degradation of writing quality noticed as the subjects advanced in experience level. This effect relates to the other nicely, though; in any case if learners are expected to remember something, or more importantly if they are expected to be able to do something, they must first apply the knowledge with some sense of guidance.

Future Directions and Research

A number of ideas for future directions and research in this area do arise from this study. One thing that seems clearly indicated by these results is the need for more curricular efforts in the area of computer science ethics. As noted in Chapter 2, a significant portion of the literature in the area of CS ethics education is devoted to emphasizing this importance, but offers little hard evidence to back that up. This study is a start, and it should lead to two basic threads.

First and foremost is the need for further study. Repeats of this study with a larger and more comprehensive sample from similar institutions, others using a sample from a different population (i.e., different types of schools), studies which look at the effects transferring might have on students and yet others which take samples from a variety of different types of schools would all be worthwhile. The primary goal of such studies is to provide a clearer picture of the state of ethics in the undergraduate computer science curriculum.

Conducting a similar study using computer science faculty as subjects is also indicated. Assessing of their own attitudes, as well as their perception of student attitudes toward academic honesty and professionalism could provide key insight. Of special interest would be their assessment of the scenarios. Are practicing faculty able to correctly identify acts as being ethical or unethical? Do they tend to apply situational ethics? Are they able to apply established codes of ethics? Clearly part of the demographic data in such a study would be some assessment of what professional society (if any) they belong to.

The final thought in studies of a similar nature is that of a longitudinal study. Being able to survey the same students as they progress through the curriculum into the early years of their employment would provide important data. In particular, how much impact does the ethics curriculum (or lack thereof) have on practicing computer scientists? Such a study could provide important information to the department that integrates ethics material throughout the curriculum. Is it being retained? Are students increasingly able to apply the material in upper division courses?

But other studies are also indicated. Much of the literature focuses on methods for presenting ethics materials that instructors have tried, but the bulk of the results are essentially anecdotal (from the instructor's point of view). In the pilot study which drove this study, a set of students was exposed to a variety of methods on teaching ethics, and was asked to evaluate the methods on a number of different criteria. This data will serve as a driving force for further study of methods. A related area is the attitude of instructors toward teaching ethics material; much of the anecdotal evidence gathered by this researcher indicates that Bear (1986) and Cunningham (1988) were on the right track. There is definitely a need for more recent follow-up studies to these works.

The second thread is that of curriculum development. The recent efforts of the ACM/IEEE joint task force (Engle & Shackelford, 2001) continue. Programs are beginning to develop across the country in the area of information assurance (computer security), which have ethics as an integral (and obvious) component. Texts, courses, and pedagogical methods need to be developed that are accessible to instructors and students

alike, and that offer the students an opportunity to apply ethical material in a meaningful context.

In the way of a meaningful anecdote, consider the following. In July 2003, this researcher attended an NSF-funded workshop on the topic of information assurance (IA), and heard an interesting comment from one of the other participants. An individual who teaches in the IA department at a major land-grant institution in the Midwest was talking about his teaching assignment; one of the courses he teaches is on ethics and professionalism. The comment that was made was very telling. In essence, the participant wanted to know if teaching this course were going to have a negative impact on the leader's tenure process. Instructor reluctance, and to some extent a perception that the material is not relevant or legitimate, is alive and well.

As Ess (2002) points out, "The Internet and its companion technology, the Web, command our moral attention as the media highlight for us sensational, sometimes bizarre, crimes which seem especially realizable through these media." As a result, it is perhaps now more important than ever before to emphasize ethics in the undergraduate computer science curriculum. While the ethical issues that arise from computing technologies may or may not be unique, there is no question that those who will manage the future of such technologies need to have a firm grounding in ethics.

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APPENDIX A
INFORMED CONSENT AND INSTRUMENT

Informed Consent Statement

By completing the attached, you are participating in a research study regarding attitudes and perceptions of undergraduate computer science and information systems students toward ethics and professional responsibility. You will find a survey regarding academic honesty as it relates to ethics and professional responsibility, as well as several scenarios which you are being asked to react to. I wish to state at the outset that:

- Your participation in this study is strictly voluntary. Refusal to participate will not in any way have an effect on your academic standing.
- At any time, you may discontinue your participation in the study.
- All data from this study will remain entirely confidential. Your name will not appear on any of the sheets of the attached survey and scenarios. Any direct quotations from your written responses will be referenced using either a pseudonym or a generic identifier like "one 3rd-year female from college A noted that . . ."
- Your department may request to see the results of the research as it pertains to their institution. They will only be given aggregate (group) data – not any identifiable individual responses.
- The major goal of this research is to determine any pressing needs for integrating ethics and professionalism material into the undergraduate computer science curriculum, and as such your responses will be of benefit to you and future computer science and information students at this and other institutions.

The biggest imposition on you as a participant is obviously the time needed to complete the survey and scenarios. However, it should take you at most 90 minutes to complete the instrument in its entirety. When you have completed it, please turn it in to the designated person in your department. I am hoping to receive the completed surveys no later than May 1, 2003. When you turn it in, you should keep this informed consent form, so that no reference to your name will appear on the survey. The surveys themselves will only be viewed by this researcher.

If you have any questions regarding this study, you may contact any of the following:

- James Bohy (researcher), Department of Computer Science, Simpson College, Carver Science Center 333, (515) 961-1834, bohy@simpson.edu
- Dr. Sharon Smaldino (co-advisor), Department of Curriculum and Instruction, University of Northern Iowa, (319) 273-3250, smaldinos@uni.edu
- Dr. Eugene Wallingford (co-advisor), Department of Computer Science, University of Northern Iowa, (319) 273-5919, wallingf@cs.uni.edu
- Office the Human Subjects Coordinator, University of Northern Iowa, (319) 273-2748

I am fully aware of the nature and extent of my participation in this project as stated above, and the possible risks arising from it. I hereby agree to participate in this project. I acknowledge that I have received a copy of this statement.

Signature of subject or responsible agent

Date

Printed name of subject

Signature of investigator

Instructions and General Comments

1. In completing this instrument, it is important that you answer the questions truthfully. Again, please be aware that no one but the researcher will be viewing your responses directly.
2. The term “computer science” is used in this instrument generically – it applies to courses in computer science, computer information systems, applied computer science, applied technology, or whatever designation your department may have given.
3. When you are asked how many *computer science* courses you have completed, do not include supporting courses for your major from mathematics, business, accounting, or other departments. Only include those courses with a specific computer science (or CS-related) designation.
4. If any of the items in the survey seems unclear to you, please do not hesitate to ask someone in your department or to contact the researcher directly. Part of what makes this research effective is receiving your feedback on these items.
5. Do not, under any circumstances, write your name on any pages of the instrument other than the informed consent form.
6. Do not, under any circumstances, refer to your institution, faculty members, or other students on any page of this instrument.

Computer Science Department Honesty and Ethics Questionnaire

Demographic information

- _____ Class (1=fresh, 2=soph, 3=jr, 4=sr) _____ Age _____ Gender (M or F)
- _____ Number of computer science courses completed (do not include courses currently taking)
- _____ Number of computer science courses currently being taken
- _____ Are you currently employed in the computer field (Y or N)?
- _____ Have you taken an ethics course in business, philosophy, or religion (Y or N)?
- _____ Does your CS department require a course in ethics and/or professionalism (Y or N)?
- _____ If your answer to the previous question was yes, have you taken it? (Y or N)?
- _____ Did you transfer to your current school with a 2-year AA or AS degree (Y or N)?

Attitudinal Survey

Directions – for each of the following questions, circle the number which most indicates your level of agreement with the statement. An answer of 4 indicates that you neither agree nor disagree with the statement. Please circle only a single number, and do not place a mark somewhere between two numbers.

1. Cheating frequently occurs on CS Department lab assignments

disagree-----disagree-----agree-----agree
 strongly somewhat somewhat strongly
 1 2 3 4 5 6 7

2. Cheating frequently occurs on CS Department quizzes and examinations

disagree-----disagree-----agree-----agree
 strongly somewhat somewhat strongly
 1 2 3 4 5 6 7

3. Among first and second year CS students, only a very few cheat

disagree-----disagree-----agree-----agree
 strongly somewhat somewhat strongly
 1 2 3 4 5 6 7

4. Among upperclass CS majors, only a very few cheat

disagree-----disagree-----agree-----agree
 strongly somewhat somewhat strongly
 1 2 3 4 5 6 7

5. Upperclass students influence fellow students as role models and examples of ethical behavior in their living groups on campus

disagree-----disagree-----agree-----agree
 strongly somewhat somewhat strongly
 1 2 3 4 5 6 7

6. If a course is too difficult (hardware problems, poor instructor, etc.), students should advise the instructor, Department Chair, or other faculty

disagree-----disagree-----agree-----agree
 strongly somewhat somewhat strongly
 1 2 3 4 5 6 7

7. If a course is too difficult (hardware problems, poor instructor, etc.), a limited amount of cheating is justifiable

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

8. Cheating only hurts the cheater, and is otherwise a "victimless crime"

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

9. Cheating is an insult to the hardworking student who does not cheat

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

10. Penalties for cheating should be very strict for first-time offenders

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

11. Penalties for cheating should be very strict for repeat offenders

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

12. Penalties for cheating should be more strict for upperclass majors than for first and second year students

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

13. Individual instructors should invest time and resources to identify and prosecute cheating incidents.

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

14. Computer professionals have an ethical responsibility to privately confront peers suspected of dishonesty with their behavior

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

15. Instructors have an ethical responsibility to privately confront students suspected of dishonesty with their behavior

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

16. Students have an ethical responsibility to privately confront other students suspected of dishonesty with their behavior

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

17. Computer professionals have an ethical responsibility to report cases of obvious dishonesty

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

18. Instructors have an ethical responsibility to report cases of obvious dishonesty

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

19. Students have an ethical responsibility to report cases of obvious dishonesty

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

20. Academic dishonesty in the CS Department should be viewed as a serious violation of Professional Ethics

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

21. The CS Department should review cases of academic dishonesty and should disqualify individuals from degree candidacy under certain circumstances

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

22. The CS Department should devote more class time to address Professional Ethics throughout its entire curriculum

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

23. Upperclass CS majors are in many ways already computer professionals, with rights and responsibilities that go with the profession

disagree	-----	disagree	-----	agree	-----	agree
strongly		somewhat		somewhat		strongly
1	2	3	4	5	6	7

Part II - Computer/Information Ethics Scenarios

Read the scenarios which follow. For each party/act in each scenario, indicate if the act is ethical/unethical, or does not involve an ethics issue. Note that you are required to circle only a single alternative.

Defend your answer in the discussion area (use the back of each page if necessary). Do your work on this individually! As in the case of the survey responses, your responses here will be confidential. The point of these exercises is to judge your understanding of ethical and professional issues.

1. The director of a federal government computer center noticed that significant amounts of computer time were being used by researchers in various research groups for game playing and other personal uses, such as generating picture calendars. These services were charged to various research projects.

She complained about this to the directors of the research groups, and they told her it was none of her business what the researchers did with their computer usage budgets. If they wanted to play games, that was all right, because it improved their computer skills and provided needed relaxing diversion.

Party - computer center director

Act - complaining about personal use of computer services

Unethical No ethics issue Ethical

Discussion:

Party - research director

Act - allowing researchers to make personal use of computer services

Unethical No ethics issue Ethical

Discussion:

Party - Researchers

Act - making personal use of computer time

Unethical No ethics issue Ethical

Discussion:

2. A manager in a computer facility quit his job and went into business as a consultant. He had been frustrated because he thought his employer ignored his many suggestions for needed improvements, including better security to protect data and programs stored in a large, multi-access (e.g. Unix) computer system. He had been given a secret password and was authorized to use it to gain access and use the computer services during his employment. At termination, the company did not tell him he was no longer authorized to use the services and did not invalidate the password.

The former manager returned to the company, offering his consulting services to assist in improving the computer security. The offer was refused. He then used the password from his own terminal to extract copies of large amounts of data and programs for the only purpose of presenting the material to the company to show them the computer operation was insecure.

Party - consultant

Act - using unauthorized access to demonstrate the insecurity of a potential client's computer operation

Unethical No ethics issue Ethical

Discussion:

3. A marketing company's employee was doing piece work production data runs on company computers after hours under contract for a state government. Her moonlighting activity was performed with the knowledge and approval of her employer.

The data were questionnaire answers of 14,000 public school children. The questionnaire contained highly specific questions on the domestic life of the children and their parents. The government's purpose was to develop statistics for behavioral profiles, for use in public assistance programming. The data include respondents' names, addresses, and so forth.

The employee's contract contained no divulgement restrictions, except a provision that statistical compilations and analyses were the property of the government.

The employer discovered the exact nature of the information on the disks and its value in the business services his company supplied. He requested that the data be copied for subsequent use in his business. The employee decided the request did not violate the terms of the contract and she complied.

Party - programmer

Act - complying with the employer's request to supply personal data

Unethical No ethics issue Ethical

Discussion:

Party - employer

Act - requesting personal data from a government study

Unethical No ethics issue Ethical

Discussion:

Party - state government

Act - not providing sufficient protection for personal data

Unethical No ethics issue Ethical

Discussion:

4. A computer operations manager has responsibilities that include data preparation and entry, computer operation, computer security, report generation and distribution. The top executive officers of the company are engaged in a massive fraud against stockholders and other investors by inflating company assets. Significant evidence of the fraud is contained in the data files stored and processed by the computer, and computer programs have been developed to assist in the perpetration of the fraud.

The computer operations manager becomes aware of the company's problems and unorthodox methods being used to solve them. He avoids being confronted with information or activities that might make him aware of possible wrongdoing.

The fraud is ultimately discovered and the perpetrators prosecuted. The prosecutor requires the operations manager to make a deposition. He states that he was ordered to perform unorthodox and unexplained acts, such as leaving large numbers of product shipping addresses blank, or making them all the same in the data entry function. He claims he was not, nor would he be expected to be, aware of the purposes of the acts. He states that his was a neutral service function, not requiring any knowledge of the company's business. He was not prosecuted.

Party - operations manager

Act - failing to act on indications of company fraud

Unethical No ethics issue Ethical

Discussion:

5. A team of artificial intelligence scientists has invented an automatic speech-recognition and voice-response system that can be used economically to serve customers of automated teller machines for most banking services. Great effort is made to convince customers that they are conversing with a person. In fact, in case of system failure, a human substitutes for the voice response and follows the same protocol and rules as the system. No capability is included to let the customer know whether conversation is with a the device or with a human.

The project team has complete freedom to exploit the invention. The team patents the invention and forms a company to manufacture and market it. It is highly successful and widely used in electronic funds transfer systems before any governmental, consumer, or professional agency has an opportunity to study and act on its implications. The scientists-turned-entrepreneurs assume no responsibility for the social implications, claiming their banking customers, who are the users of the product, have that responsibility.

Party - AI scientists

Act - marketing a device that can deceive people and not accepting responsibility for their product

Unethical No ethics issue Ethical

Discussion:

Party - banks

Act - using a device that deceives customers

Unethical No ethics issue Ethical

Discussion:

6. A politician decides he can support his position on an issue by using the popular methods of computer modeling and simulations. He hires a systems analyst and arranges for staff support and funding to develop a sociological model and run simulations. Although he is too shrewd to instruct the analyst to force the study to the desired conclusions, he leaves no doubt as to the results he expects, and he makes much of the idea that the analyst is an important member of his team. As is often the case, the data required for the development of the model proves to be soft, in that the true values of some important parameters and variables cannot be accurately determined. In this case, the analyst finds that some critical data vary by as much as 10%, depending on the sources from which they are derived. Therefore, he has no difficulty in causing the simulations to produce results that would support his employer's announced position. Everyone is satisfied and the analyst completes his job without further experimentation.

Party - systems analyst

Act - deliberately performing the simulations to produce the desired results

Unethical No ethics issue Ethical

Discussion:

Party - politician

Act - assuring the results he hoped for

Unethical No ethics issue Ethical

Discussion:

APPENDIX B

QUOTED SUBJECT'S DEMOGRAPHIC DATA

Subjects quoted in qualitative results (sorted by pseudonym)

Name	Age	Gender	Level	College
Alice	22	Female	Junior	A
Allan	19	Male	Freshman	D
Angela	32	Female	Sophomore	B
Brent	19	Male	Freshman	D
Cindy	27	Female	Senior	B
Clint	21	Male	Junior	C
Dave	20	Male	Freshman	D
Dawn	21	Female	Sophomore	C
Dean	19	Male	Freshman	C
Diana	22	Female	Freshman	C
Dirk	22	Male	Senior	D
Donald	21	Male	Sophomore	C
Donna	20	Female	Junior	D
Douglas	19	Male	Freshman	D
Grant	19	Male	Freshman	D
Grover	21	Male	Freshman	D
Jackson	21	Male	Sophomore	A
Janet	21	Female	Senior	D
Jason	19	Male	Sophomore	D
Jeff	19	Male	Junior	C
Josef	20	Male	Freshman	D
Kirk	37	Male	Senior	C
Leon	24	Male	Freshman	D
Lincoln	21	Male	Senior	D
Margaret	19	Female	Freshman	D
Marvin	19	Male	Sophomore	A
Maurice	32	Male	Freshman	D
Megan	19	Female	Freshman	D
Melvin	20	Male	Senior	D
Milton	48	Male	Senior	B
Nancy	19	Female	Freshman	D
Paul	20	Male	Senior	C
Peter	22	Male	Senior	D
Rebecca	19	Female	Freshman	D
Stephen	18	Male	Freshman	D
Tim	20	Male	Sophomore	C
Tom	20	Male	Senior	C
Warren	20	Male	Sophomore	A