APPROVAL SHEET

Title of Dissertation: Assessing Undergraduate Students' Perceptions of Ethics Instruction in a Computing Curriculum

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Doctor of Philosophy, 2008

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Dudley-Sponaugle, A. (2007) *Under Representation of African American Women Pursuing Higher Degrees in Computer Sciences/Technology Fields.* In Diversity Issues in IT Education: Issues and Challenges edited by Dr. Goran Trajkovski © 2006 IRM Press.

Dudley-Sponaugle, A. & Lazar, J. (2004) *Web Accessibility for Users with Disabilities: a Multifaceted Ethical Analysis,* in Information Security and Ethics: Social and Organizational Issues edited by Dr. Marian Quigley © 2004 IRM Press.

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COSC 111: Information and Technology for Business
Introduction to the use of information technology to retrieve, filter, process, classify, sort and evaluate data and information in a business environment. Problem solving, creative thinking, effective communication, and team building skills will be use throughout the course. Labs covering library information systems, the Internet, word processing, presentation software, spreadsheets, and databases will be emphasized.

COSC 321: Computerization and its Impacts
This course examines computer technology and its socioeconomic impacts on organization and individuals. The class will explore issues in forms of communication, economic and organization proportions, freedom of information, work-life, electronic communities, privacy, ethics, professionalism, security, computers in education and other issues that computerization impacts in regards to society, rather than an individual perspective.
COSC 418: Ethical and Societal Concerns of Computer Scientists
This course is designed to help students deal with societal and ethical issues as professional computer scientists or as knowledgeable users. Students will become more aware of ethical issues involving computers in applied areas as well as those arising from design and development of this technology. The affect of computer usage on the human condition in society will be discussed, with examples taken from several areas of application.
COSC 480: Senior Seminar: Professional Ethics
Prepares students to deal as professionals with the social and ethical issues in the computing sciences and make them aware of the broad applications of computers and the implications of these applications.

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ABSTRACT

Title of Document: ASSESSING UNDERGRADUATE STUDENTS' PERCEPTIONS OF ETHICS INSTRUCTION IN A COMPUTING CURRICULUM

Alfreda Dudley Sponaugle, Ph.D. 2008

Directed By: Dr. Zane Berge, Professor, Education

The topic of ethics in the computing curriculum is essential to the credibility of computing programs. Over 20 years ago, CSAB (formerly the Computing Sciences Accreditation Board) deemed that the inclusion of ethics is necessary for the educational development of students in the computing curriculum. CSAB "…is the lead society for accreditation of programs in computer science, information systems, and software engineering, and is a cooperating society for accreditation of computer engineering. In this capacity, CSAB has responsibility for the proposal of accreditation criteria and for the selection and training program evaluators." (www.csab.org) The Accreditation Board for Engineering and Technology (ABET) approves all criteria. (www.abet.org)

The problem, however, is that there is no documented literature to provide education on the successful or lack of successful implementation of ethics in the computing curricula. In addition, there is very little information on students' experiences with a computer ethics course. The purpose of this study is to examine the experiences of students with a computer ethics course offered at University X and

provide a baseline study to increase awareness and provide direction in the development of computer ethics in the computing curricula.

This study assesses students' perceptions of an ethics' course content and structure. Students' perceptions are based on their experiences with the course content and application. The researcher examines and interprets students' responses using a quasi-experimental design. The instruments used in the experiment are pre and post evaluation surveys distributed to students in the researcher's ethics courses. The pre evaluation survey is distributed before the beginning of the ethics course. The post evaluation survey is distributed on the last day of the ethics course.

The research looks at the data in terms of correlation between student perceptions of the ethics course pedagogy and the following elements:

- Student major, rank, gender, ethnicity
- Previous computing and ethics experience

The researcher is seeking to obtain information concerning:

- The impact of course pedagogy on students' perceptions of ethics instruction;
- The correlation between knowledge of computing issues and students' perceptions of ethics instruction; and,
- The correlation between students' major, rank, gender, and ethnicity and students' perceptions of ethics instruction

The significance of the study is that it is a baseline for future development and research in this area. The major findings of this research indicated students self-reported that: the current pedagogical methods used in the course was instrumental in increasing awareness of ethics in computing; the four-step analysis approach for

decision-making was instrumental in increasing awareness in ethics; and, exposure to the computer ethics course increased the importance of ethics in computing.

The results of this research provide important insight on assessment of teaching and ethics course and ethical concepts in the computing curriculum.

ASSESSING UNDERGRADUATE STUDENTS' PERCEPTIONS OF ETHICS INSTRUCTION IN A COMPUTING CURRICULUM

by

Alfreda Dudley Sponaugle

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, Baltimore County, in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
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1.1 Background

The application of ethics to computer technology is becoming an essential aspect of the computing curricula. Though ethics courses have been taught for over 20 years, the Criteria for Accreditation of Computer Science Programs, and more recently the Criteria for Accreditation of Information Systems Programs require that computer ethics be a part of every accredited program in the United States (http://www.csab.org). The focus on the inclusion of ethics in a computing curriculum is to give programs credibility and to enhance the students' decision-making skills regarding computing technology. ABET, the organization responsible for the approval of all criteria for computing curricula, has defined specific general criteria and program criteria for computing programs i.e., computer science, information systems, and information technology curricula in which the topic of ethics is included. The following is a list of new program outcomes recently approved in the 2008-2009 Criteria for Accrediting Computing Programs:

Program Outcomes

The program has documented measurable outcomes that are based on the needs of the program's constituencies. The program enables students to achieve, by the time of graduation:

(a) An ability to apply knowledge of computing and mathematics appropriate to the discipline

(b) An ability to analyze a problem, and identify and define the computing requirements appropriate to its solution

(c) An ability to design, implement, and evaluate a computer-based system, process, component, or program to meet desired needs

(d) An ability to function effectively on teams to accomplish a common goal

(e) An understanding of professional, ethical, legal, security and social issues and responsibilities

(f) An ability to communicate effectively with a range of audiences

(g) An ability to analyze the local and global impact of computing on individuals, organizations, and society

(h) Recognition of the need for and an ability to engage in continuing professional development

(i) An ability to use current techniques, skills, and tools necessary for computing practice

(http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/A004%2008-09%20Accredition%20Policy%20and%20Procedure%20Manual%2011-8-07.pdf)

One question that is under constant debate in the computing programs is when to introduce ethics in the curriculum. There are those responsible for the accreditation of the computing curriculum that prefers the integration of ethics, at various stages, into the computer science curriculum. Their argument is if ethics is not integrated, the course or module is given either too early or too late. It is their position that students can profit from learning computer ethics at an earlier stage in their academic pursuits. Still others argue that at the beginning of their computer

science courses, students should become aware of the appropriate use of computers, as well as, respect for copyright and intellectual property issues. On the other hand, they will not be ready to absorb some of the topics until they have acquired some maturity in upper-level computer science courses. For example, they can have a much better understanding of viruses after taking a course in operating systems.

While integrating ethics into all computing courses is desirable, it seems that faculty are uncomfortable teaching ethics and find that they have so much essential computer science material to cover that they just skip the ethics module of the course. Since this is frequently the case, it is often difficult to be certain that the integration of ethics into other courses across the curriculum really works. So many programs now teach computer ethics as a separate course. Offering a separate course in ethics has proven to work well; it meets accreditation guidelines and often serves as a course in which every major develops and applies their oral and written skills. When ethics is a separate course, ideally, the first-level of the Computer Science curriculum should include appropriate information about computer usage, copyright, and intellectual property issues (Dudley-Sponaugle & Lidtke, 2002).

Another issue to address in teaching ethics in a computing curriculum is the faculty. In a computer science curriculum, it is not always easy to find faculty who are willing or knowledgeable enough to teach an ethics course or faculty members who consistently incorporate such modules in their computer science courses. Computer science faculty are accustomed to working in problem-solving situations where they know the answers that the student should provide on an exam—either the

answer is right or wrong. There is little credit given for the method of obtaining the result, especially if differing results are appropriate.

The pedagogical methods used in an ethics class are different from the usual computing class. In an ethics class, most or all the time is devoted to discussion based on suppositions. Computing faculty is not very comfortable teaching in a format where there are no definite solutions or outcomes. It is also difficult to grade essays and student presentations, as opposed to scoring examination questions (Dudley-Sponaugle & Lidtke, 2002).

Literature indicates the importance of the application and training involved in teaching computer ethics. For example, in the DOLCE (Developing Online/Offline Computer Ethics) Project, sponsored by the National Science Foundation, a main emphasis was on improving instruction of computer science students with regard to computer ethics (Moskal, King, Miller & Camp, 2003). The project identified three major goals:

- To increase faculty and students' awareness of ethical issues in computer ethics;
- To increase faculty and students' content knowledge in computer ethics;
- And, to increase faculty knowledge of how to teach and assess computer ethics (Moskal, King, Miller & Camp, 2003, p. 3).

There are specifications on how the topic of ethics should be applied in a computing curriculum [Available at: www.iscc.unomaha.edu]. The pedagogy recommended by ISCC '99 mainly suggests the incorporation of philosophical theories for analyses of problems arising from computing technologies. However, no

data exists to indicate whether adopting this pedagogy in a computer science curriculum or other computing curricula is successful or unsuccessful. The ACM, IEEE-CS curricular guidelines for computer science, information systems, information technology and software engineering all indicate the need for ethics in the curriculum, but do not specify pedagogy nor indicate the effectiveness of this inclusion.

Therefore, after teaching computing ethics for several semesters, the researcher wanted to gain feedback from students enrolled in her computer ethics courses. In an attempt to gain understanding, she conducted a pilot study with students enrolled in her Ethical and Societal Concerns for Computer Scientists course in spring 2004. Students were solicited to volunteer to be individually interviewed. The results of the pilot study lead the researcher to consider further research in the area of students' perceptions of ethics in a computing curriculum, which is the basis of the dissertation. The next section describes the pilot study.

1.2 The Pilot Study

The researcher conducted a pilot study to gain feedback from students enrolled in her computer ethics courses on course content and their ethical practices. The pilot study was conducted during the last two weeks of the spring 2004 semester.

Data was collected from student interviews in the researcher's spring 2004 Ethics and Societal Concerns for Computer Scientists class. This course is a three-credit undergraduate course. It is offered in the fall, spring, and summer semesters. The prerequisites for this class are: two science courses or one math course and one

science course. There are additional recommended courses, which are: a previous computer course and an upper-level English course. There were 27 students enrolled in this course for the spring 2004 semester. This course counts as a requirement for computer science and computer and information systems students in the computing department. This course also counts as a general education requirement course under the Science and Technology Category, which means it is open for any students in any major at University X. Figure 1 shows the characteristics of the student population in the researcher's computer ethics courses during the spring 2004 semester:

Figure 1. Characteristics of students enrolled in Ethics and Societal Concerns for Computer Scientists spring 2004.

Majors vs. Non-Majors

Computing Major	Non-Computing Major
15	12

Male vs. Female

Male Students	Female Students
18	9

Student's Status

Freshmen	Sophomores	Juniors	Seniors
1	7	9	10

The researcher solicited volunteers to be individually interviewed from the computer course. Five participants volunteered to be individually interviewed by the

researcher. Figure 2 describes the characteristics of the students who participated in the interviews.

Figure 2. Characteristics of participants in the pilot study

*Name	OLLA	JOHN	ROBIN	CRAIG	MICHAEL
Major	Computer and Information Systems	Computer Science	Computer and Information Systems	Marketing & Mass Communications	Secondary Education/History
Status	Junior	Senior	Senior	Junior	Junior
Gender	Female	Male	Female	Male	Male
Race/Ethnicity	African	Caucasian	Caucasian	Caucasian	Italian
Citizenship	Nigeria	U.S.A.	U.S.A.	U.S.A.	U.S.A
Background	Degree in building technology from Nigeria	Residential Assistant at Towson University	Quality Assurance Analyst	In charge of Bulk Material and gives OSHA training for employees at Bethlehem Steel Corp.	Served in Italian Military; Worked in a Machine Shop

***Note: The names are not the actual names of the student participants.**

Distinguishing the goals and objectives assisted in the integration of various resources in the development of the researcher's ethics course. The researcher identified two goals: 1) Students will be able to appreciate the need for ethics as applied to computer technology; and, 2) Students will be able to analyze and debate ethical issues regarding computer technology using a structured problem solving approach. In addition, she identified the following objectives to be accomplished in the ethics course:

1. Identify ethical issues.
2. Analyze ethical issues using a structured problem solving approach.
3. Debate their position on ethical issues
4. Demonstrate their knowledge of ethics by the use of problem solving and critical thinking approaches.

Table 1 presents the assessment tools for the established goals and objectives of the ethics course.

Table 1
Established Objectives and Assessments of the Ethics Course

Objectives	**Assessments**
Identify ethical issues	Homework assignments In-class discussion Case Study Projects Final Paper
Analyze ethical issues using a structured problem solving approach	Homework assignments In-class discussions & participation Case study Projects Final Paper
Debate position on the ethical issue identified	In-class discussions & participation Case study Projects Final Paper
Illustrate the value of ethics in making decisions about computer technology	In-class discussions & participation Case study Projects Final Paper
Demonstrate knowledge by use of problem solving & critical thinking approaches	Homework assignments Case study Projects Final Paper

The researcher identified the following interview questions for the purpose of the pilot study:

- In what ways did the course help the student become more aware of the ethical issues involving computer technology?
- After completing this course, how relevant would students rank the topic of ethics in a Computer Science/Information Science major?
- Which exercises did the student feel assisted their understanding and analysis of ethical issues? Why?
- Before taking this course, how aware was the student of ethical issues involving computer technology?
- After completing this course, how does the student feel about his/her ability to make ethical decisions involving computer technology? Why?

The full text of interview responses is presented in Appendix A.

In response to the question about students' level of awareness of ethical issues before taking this class, all of the students' responses indicated that their awareness of ethical issues of computing technology was based on their practices and experiences.

One common practice that students had engaged in was illegal downloading of music. For example, John's comments were representative of student's practices: "*I've done that plenty. (Laughs) I won't lie about it. Yeah, and I made up my own excuses as to why it was okay for me to do this."* (John, May 5, 2004)

Even though many engaged in this practice, 3 out of the 5 participants indicated that they were aware of the ethical implications. However, Michael's comments were atypical, in that his awareness of ethics was not from experience or practice: "*...I did a lot of readings on Martin Luther, Thomas Aquinas, Kant, and I*

figured that this course would not be too far from that basic direction." (Michael, May 5, 2004)

The second interview question dealt with the ways the course assisted the student's ethical decision-making abilities involving computer technology. Here are some examples:

Michael's response*:*

...It has exposed me, as I was saying, to the different facets of ethical issues as they apply to legislation that has been passed…. I had not thought much personally about those issues. (Michael, May 5, 2004)

Robin's response:

…It is more of the law side of it. Like, how strict or lose the laws are. I just didn't know. It's not something that you learn in any other class. (Robin, May 5, 2004)

John's comments focused on the helpfulness of course activities with decision-making: *... but, I think that method helps me see the different ways you could think about one problem, but it's most useful in a group environment, where several people are discussing it all. Because, I know for a fact, I can't think of all different viewpoints and I need somebody to play off on; at least, to talk to while I'm trying to figure it out myself. This method has been helpful because I thought about who the stakeholders are. That's an interesting topic, because it is a lot more than you think.* (John, May 5, 2004)

All of the students believed that the information from the course assisted in their ethical decision-making abilities involving computing technologies.

In the third interview question, the researcher was trying to get the students' feedback on class exercises that assisted in their understanding and analysis of ethical principles. The students identified different class exercises that assisted their understanding and analysis of ethical issues.

John's comments reflect his view of the course assignments: *I have to say the packet of worksheets you gave us, that have you go through the steps. Once you taught us everything in it, it was an easy way to have everything side-by-side; like, you had to follow every step to see why it builds up the way it does. And, once you have, I think, Step III, where you have all the theories all next to each other, you can see once you do Step IV, they all compare. And each one looks at the dilemmas, and how you can use each one to your advantage or disadvantage.* (John, May 5, 2004)

Craig said: *The mock play of the Dean and Pornography enlightened me a whole lot because there were a lot of social issues around a computer ethical problem.* (Craig, May 5, 2004)

Robin said: *The case studies really helped you put in perspective, like I'm really going to have to deal with this someday. This is not just some class I'm taking to learn ethics; this is something I'm going to have to deal with.* (Robin, May 5, 2004)

The answers varied with each student. To the researcher, it validated the variety of exercises that was included in the course in order to help students become proficient in making ethical decisions.

When asked how they felt about their ability to make ethical decisions involving computer technology towards the end of the course, the students replied that at this point in the semester they felt confident in making ethical decisions.

John commented: *I feel that I have a great ability to do that- to make ethical decisions. And, I feel that I have really learned a lot about what that really means in making an ethical decision. … Yeah, I learned what an ethical decision really is and how that contributes in what is right and wrong. I really thought a lot more about it, you know*. (John, May 5, 2004)

Craig noted: *When I first started class, I had separate ethical feelings for the computer and separate social ethical feelings. I never thought they intermingled until I took the class.* Michael commented: *Well, this course has exposed me basically, to the technicalities of the ethical issues that are involved with computer technology; and, issues that previously did not exist, necessarily, because of the technology involved*. (John, May 5, 2004)

All of the students' responses indicated increased ethical decision-making abilities and awareness towards the end of the course.

The researcher asked if students viewed computer ethics as a relevant course for Computer Science/Information Science majors. The following are two responses to this inquiry:

Olla's comments: *Definitely, I do. Like I said after I saw all that was happening, I wanted to know more about computers. ... Definitely, I do. Like I said after I saw all that was happening, I wanted to know more about computers.* (Olla, May 5, 2004)

Michael's comment*: ...so, whether your course is in Education, Computers, Social Studies, or Anthropology, ethics should always be in the forefront in how you interact in your personal relationships and society.* (Michael, May 5, 2004)

All of the students responded that this course was relative in a computing curriculum. Two of the five students were not technology majors, but they agreed with the others that this course is definitely important.

The results of the pilot study revealed valuable information to the researcher about students' perceptions of the course content and structure. Moreover, the information from the pilot study raised more questions and serves as the foundation for continued research. The next section introduces the researcher's dissertation study.

1.3 Purpose of the Research Study

The researcher found sparse literature regarding the assessment of students' perceptions of a computer ethics course in a computing curriculum. After conducting an extensive and comprehensive search on this topic, there was one recorded dissertation study regarding the assessment of students' perception of ethics education in an undergraduate computer science (Bohy, 2003). Whereas Bohy's research measures students' perception of ethics education in a computing curriculum, it does not specifically focus on student's feedback of ethics from a computer ethics course (Bohy, 2003, p 16).

The majority of the literature that the researcher found focuses on the structure, pedagogy, and inclusion of ethics in a computing curriculum (Appel, 1998; Shulz & Grodzinsky 1997; Spradling, 2007; Tavani, 1999). An example of this type of literature would be M. J. Wolf's (2005) study that researched the debate format in a computer ethics course. Wolf's main objective was to determine whether students perceived the debate to be a valuable learning tool in a computer ethics class. These particular studies, as many others, do not specifically or directly address the student's perceptions of the topic of ethics or a computer ethics class.

Some literature documents students' perceptions of an ethics module in application to a computing course (Applin, 2006; Gotterbarn, 1999; Houle, 1997; Martin, 1997). Again, these types of literature and/or research do not specifically or directly address students' perceptions of the topic of ethics in a computing course or a computer ethics course. An example of this type of literature would be J. E. Bohy's (2004) qualitative study with students from his systems development course. Bohy's study focused on the feedback from students on learning activities conducted in this class. He mentions the ethics variable as it relates to that specific computing course but only in passing: "Even if ethics is being incorporated into the curriculum in some fashion, it is not clear that the students are being made to apply it in any way." (Bohy, 2004, p.3) Whereas the study measured students' feedback, it does not deal with students' perceptions of computer ethics. Other documented literature concentrates on the knowledge and attitudes of students of ethical issues as it relates to computing policies or use (Bowen, M. Burmeister, O.K. et al., 2006; Siponen & Vartiainen 2004; Yamanoue, T., Nakanishi, M., et. al., 2005; Yuan, 1998). Like other literature the

researcher found in this area, most of the research focused on the results of ethical practices rather than evaluating student's perceptions of an ethics course in a computing curriculum.

The researcher's pilot study indicated that there is more information that could be obtained from students addressing their perceptions of a computer ethics course. Therefore, this study addresses the impact of the ethics course on the student's perception on the relevance of this topic in computing. In addition, this research investigates how computing (i.e. computer science, information systems, etc.) students and non-computing students perceive computer ethics courses, which could be the basis of applying ethics in their professions.

The study provides a baseline for assessing a four-step analysis tool used to assist students in ethical decision-making applications regarding computing. Specifically, the study will be an attempt to find if there are any differences in the level of knowledge of application of ethics before and after taking the course; and, to find if any differences exist in that application between computing students and non-computing students. Based on the purpose of this study, the following research questions are formulated.

1.4 Research Questions

1. How will students perceive ethics after being exposed to a structured analysis approach (a four-step analysis decision-making tool)?

2. How do students' perceptions of the importance of ethics in computing practices change after being exposed to a computer ethics course?

3. How do students perceive the ethics course pedagogy after taking the course?

1.5 Research Hypotheses

The following research hypotheses are derived from the above research questions:

1a. Students' (computing and non-computing majors) perceptions of ethics will increase after using the four-step analysis decision-making tool.

1b. Perception of decision-making abilities will be different between computing majors and non-computing majors after using the four-step analysis decision-making tool.

2. Students' (computing and non-computing majors) perceptions of the importance of ethics regarding computing practices will change after taking the ethics course.

3. Students' (computing and non-computing majors) view of ethics in computing will change after exposure to the course pedagogy.

1.6 The Approach Used in the Research Study

Using a quantitative approach, the reasoning of this research will be based on deductive inference. The study will focus on analysis of data collected from pre and post evaluation surveys completed by student participants enrolled in the Ethics and Societal Concerns for Computer Scientists and Professional Ethics courses during the fall and spring semesters. Since this will be on a voluntary basis and because of the time of this study, the researcher will collect between 50 to 100 evaluations. Analysis

will include the frequency distribution of response and relationships between the variables using collected data methods, such as: Chi Square and independent sample t-tests. This type of research employs descriptive statistics for interpretation. The reasoning will be based on a deductive inference, which is based on the following premises:

Premise 1: Computing students and non-computing students are exposed to situations, which call for applications in decision-making processes.

Premise 2: Computing students use some sort of decision-making processes in all computing courses. Non-computing students may use some sort of decision-making process in some of their courses.

Conclusion: Computing and non-computing students will have no problems using a structured analysis approach in a computer ethics course.

1.6.1 Population

The research study will be executed at a well-known, metropolitan university (University X) located in Maryland. At University X, the Computer Science Department offers two separate ethics courses, which are identified as Professionalism and Computer Ethics a one-credit course, and Social and Ethical Issues for the Computer Scientist a three-credit course. The fundamental purpose of these courses is to prepare technology students to practice ethics in their profession. Participants involved in the research study are from the researcher's sections of these courses. The researcher designed the ethics course content and structure of these ethics courses. To evaluate the student's perceptions from these two computer ethics courses, a pre and post evaluation survey is distributed to measure students'

knowledge of ethics before and after taking the ethics courses and to assess the students' perceptions of the course and the structured analysis tool developed by the researcher. (Copies of the pre and post evaluation surveys are in Appendix B.)

1.7 Definition of Key Terms

Computing is an inclusive term that includes the following: computer technology, information technology, computer science, information science, and information systems.

Structured Analysis Approach (Four-Step Analysis) – The four-step analysis tool uses a structured analysis approach. The structured analysis approach is a top-down methodology approach that contains a systematic application of ethical principles for decision-making to an issue or dilemma.

Computer ethics is an area that incorporates the application of rules and acceptable behavioral practices in using computing.

Computing students are identified as Computer Science majors, Computer and Information Systems majors, Information Technology majors, and students that are double majoring in Computing and the following areas: Mathematics and Business. Non-computing students are identified as any majors that are not computer-oriented. The following are terms that will be referred to and used in this research:

- *Perception* (noun): The word perception comes from the Latin word "percipere", meaning to seize, to understand. The Oxford English Dictionary (1989) defines *perception* "as the ability to see, hear, or become aware of something through the senses; the process of perceiving; a way of

understanding or interpreting something and, *intuitive* understanding and *insight*" (vo1.12). Perception is indicated in this research study as how successful or unsuccessful the students assess the ethics course in assisting with increased *awareness* and application of ethics in computing.

- *Awareness (*adjective**)** The Oxford English Dictionary (1989) defines *awareness* "as having *knowledge* or *perception* of a situation or fact. The term awareness does not necessarily imply understanding, just an ability to be conscious of, feel or perceive" (vol. 1). This term is used interchangeably in this study with the terms *perception, view, and knowledge* based on the construct of the questions.
- *Knowledge* (noun) The Oxford English Dictionary (1989) defines *knowledge* "as information and skills acquired through experience or education; the sum of what is known; and *awareness* or familiarity gained by experience of a fact or situation" (vol. 2). In this research, students are asked to respond to questions based on what has become known to them through the ethics course.
- *View* (noun) The Oxford English Dictionary (1989) defines *view* as "mental contemplation or vision (alone or combined with ocular inspection); observation, notice; a particular manner or way of considering or regarding a matter or question; a conception, opinion, or theory formed by *reflection* or study; an aspect or light in which something is regarded or considered; and *opinions*, *ideas*, or *theories*, of an individual or speculative character, held or advanced with regard to some subject" (vol. 19).

Self-Reports is a term used in research in which subjects of the study respond to the questions from their point of view. This term will be used in this study for reporting the student's responses on pre and post evaluation survey questions.

The following are organizations and societies that will be referred to in this research:

- ACM - Association of Computer Machinery
- IEEE – Institute of Electrical and Electronics Engineers
- CC91 – Computing Curriculum Report (1991)
- ACM/SIGCAS – ACM Special Interest Group on Computers & Society

1.8 Predicted Limitations of the Research Study

The predicted limitations of the study are based on the following researcher's biases:

1. The study examines the outcomes of the researcher's ethics courses based on her pedagogical designs, which are not universally used in all or other computer ethics courses.

2. The findings may be biased as a result of conducting the experiment with student volunteers from the researcher's sections of ethics courses.

3. This study does not examine or take into account students' prior exposure to the topic of ethics: this includes previous ethics courses and/or modules taken in other disciplines.

4. The findings may be biased as result of using the subjects' self-report responses to interpret data analyses. Self-reporting can reflect the subject's perceived personality or self- interest, which may bias responses.

1.9 Assumptions of the Research Study

The following are some of the assumed relationships to be examined in this research: 1) The perception of ethics as a viable subject matter in a computing curriculum differs from the student's perspective based on major. 2) There is a difference between computing majors versus non-computing majors in their level of awareness of computer ethics before taking the course. 3) There is a difference between computing majors versus non-computing majors in their level of understanding ethical issues surrounding computer technology after taking the course. 4) There is a difference between computing majors versus non-computing majors in their comprehension of the structured analysis approach to decision making. And, 5) there is a difference between computing majors versus non-computing majors in their willingness to use the structured analysis approach after the ethics class.

1.10 Significance of the Research Study

The purpose of the research is to look at possible connections between the ethics course pedagogical structure and students' awareness and application of ethics in a computing environment. The information and knowledge gained from this study can assist in computer curriculum development and training of faculty who teach or plan to teach computer ethics courses. The study provides a foundation for future research in assessment of the structured analysis approach used in the ethics courses.

1.11 Summary and Preview of Chapters Ahead

This chapter states the purpose of this research study. A brief introduction on the status of computer ethics in the computer curriculum is provided. A problem is identified, which establishes the reason for the pilot study, which led to the research study. Key terms used in the research study are identified. The chapter closes with predicted limitations, assumptions, and significance of the study.

Chapter two is a review of the literature in terms of the definition and approach of ethics, the review of ethical pedagogical structures in other curricula, the implementation of ethics in the computing curriculum, and the researcher's ethics courses.

The research methodology is presented in chapter three. The research approach and methodology are defined. The research strategy for the study is presented, which involves five areas: Identification of the population; definition of the instrument; data collection process; statistical procedures and methodology; and summary.

Chapter four presents the analysis of data and the findings. This phase of the research examines relationships between students understanding and application of ethics using computing technologies with the pedagogical methods used in the ethics course. A discussion of the findings in relationship to the research question is presented, along with discussion of the limitations of the study.

Chapter five introduces and synthesizes the major findings of the study. The implications from the research are stated. In addition, suggestions for future research are presented.

Chapter 2: Literature Review

Overview

- Ethics
- Ethics Across Curricula
- Computer (or Cyber) Ethics
- Computing Curriculum - Background
- Ethics Integration in the Computing Curriculum
- Structure of An Ethics Course
- Conclusions and Summary

2.1 Ethics

"The term 'ethics' comes from the Greek word *ethike* that means 'character,' and indeed the ancient Greeks conceived issues about what people should do in terms of impact upon character [Aristole, 350 BCE]" (Schultz, 2005, p. 1). Currently, the term "ethics" usually refers to concerns about what people should do. One definition explains: "Ethics is the philosophical study of morality, a rational examination into people's moral beliefs and behavior" (Quinn, 2004, p. 48).

There are two basic approaches to ethics – applied and theoretical. Theoretical-based ethics focus on historical, metaphysical, and epistemological issues from a philosophical view (Scharff & Dusek, 2001). Applied ethics focuses on the application of philosophical theories and professional codes to problems or issues.

> Applied ethics is a relative of theoretical ethics, for in the real world we have to convert our beliefs to actions. However, a*pplied ethics*, unlike theoretical ethics, refer to practice, when we undertake to do things that have consequences for others, things that we can be held responsible for doing (Woodbury, 2003, p. 15).

Current events in society show that numerous incidences involving unethical practices are widespread. In recent years, there has been much media coverage of unethical behavioral practices in the workplace, especially focusing on high-level personnel. The intensity of this focus is based upon the numerous scandals of improper actions of individuals and organizations (e.g., Enron, Worldcom, etc.). Ethical codes of conduct do exist in businesses. However, in light of the numerous scandals, professional ethical practices are being reassessed as a major priority in organizations (Dudley-Sponaugle & Lazar, 2005, p. 165).

There are many reasons why individuals and/or groups do not practice ethical behavior. Past psychological research (Rest, 1983) indicates that there are four distinct reasons individuals fail to behave morally (or ethically):

1. Individuals are not aware of the moral issues that are present.
2. Individuals may be deficient in formulating a morally defensible course of action.
3. Individuals may fail to give priority to moral concerns.
4. Individuals have moral failings resulting from an inability or unwillingness to implement an effective action plan (Bebeau, 1993, pp. 1-2).

Another reason that individuals do not practice ethical behavior may be due to the fact, "there are no strong incentives or motivations to do so" (Bowyer, 1996, p.7).

Professional organizations and educational institutions are adopting various tactics to deal with the application of ethics. In their fields, Bebeau (1993)

introduces Rest's assessment strategies in the applications of professional ethics instruction:

- Ethical Sensitivity Tests – places students in real life situations for interaction
- Moral Judgment – studying the outcomes of an ethics program
- Moral Motivation and Commitment – three measures to adapt to the measurement of motivation and commitment:
    - Interview students following a simulated ethics encounter
    - Assess action tendencies and the underlying values in situations with ethical problems
    - Measure underlying concepts of authority and responsibility that are common to the various models of professionalism described by moral philosophers
- Moral Implementation – Evaluation of moral implementation skills (in clinical settings) "Although the transferability of these criteria to unstructured clinical cases has not been tested, the checklist may be adaptable to role play settings …" (Bebeau, 1993, p. 4).

Bebeau (1993) summarized the following results from the strategies that might be useful for designing an outcome-based ethics curriculum:

- Personal beliefs and biases can affect interpretation of ethical problems and, ultimately decision-making.
- Students do not come to professional education with a clear view of their role about responsibility.

- To be effective, a program in professional ethics should examine a wide range of ethical dilemmas that confront a profession.
- Dilemma discussion techniques are effective in promoting moral reasoning development, but explicit criteria, practice, and feedback are needed to improve writing skills in moral argument and ethical decision-making (Bebeau, 1993, p.8).

2.2 Ethics in other Disciplines

There are several approaches in teaching ethics in curricula. From a philosophical standpoint, ethics can be taught either by philosophical theories or by application of philosophical theories. In developing a computer ethics course in a curriculum, the outcome or goal is critical to the development of a pedagogical structure. Some ethics courses are designed to assist students in the application of ethics; others are designed to bring about a change in the student's attitude or practices. "In both cases, there is an underlying assumption about what it means to learn and be 'educated'; indeed, who educators think students should become defines the aims and purpose of educational practices" (Todd, 2001, p. 431). Todd's (2001) argument is that there is a pedagogical demand for a *learning to become* focus in ethics curriculum development. However, Todd (2001) does concede that the *learning to become* pedagogy can be either a positive and negative factor in education.

> On the one hand, it touches on the hope that people can think differently, can change the way they relate to each other, and can form new understandings of themselves and the world that makes possible the very act of teaching and

> learning. On the other hand, the demand for *learning to become* carries with it a great burden—for, if pedagogy is about the becoming of the subject, then it can become a tool for the most oppressive ends (Todd, 2001, p. 435).

Todd's (2001) approach on ethics curriculum development is from an educational and psychological background. However, it is applicable across curricula.

Several professions and curricula have had ethics curriculum in place for many years, such as, the legal, business, and medical curricula. Ethics is a vital topic in each curriculum. Each area has defined goals and outcomes in the ethics curriculum. There are various teaching and curriculum development approaches to ethics instruction. The following are ethics curriculum examples from each area:

2.2.1 Medical Ethics Curriculum

Medical ethics has been around for thousands of years. However, according to Goldie, Schwartz, & Morrison (2003), medical ethics has become prominent only during the last 30 years in medical education. According to the authors' study, they found "a diversity of goals set and methods use in medical ethics education" (Goldie, Schwartz & Morrison, 2003, p. 468). The authors' developed an assessment tool to evaluate the outcome of the medical ethics course on first year medical students. The authors reported that although there is no consensus on a single model for teaching or design[ing] a medical ethics course, "a number of recommendations have been made about its incorporation into medical curricula" (Goldie, Schwartz & Morrison, 2003, p. 469). Table 2 presents an example of recommendations from The UK Consensus Statement on teaching medical ethics and law in the United Kingdom.

Table 2. *UK Consensus Statement Recommendations*

Teaching should allow students to:

1. Understand the ethical principles and values underpinning the practice of good medicine.
2. Be able to think critically about medical ethics issues, critically reflect upon their own beliefs, understand and appreciate alternative, and sometimes competing approaches, and be able to argue and counter-argue in order to contribute to informed discussion and debate.
3. Know the main professional obligations of doctors in the United Kingdom.
4. Have knowledge and understanding of the legal process and the legal obligations of medical practitioners sufficient to enable them to practice medicine effectively and safely.
5. Appreciate that ethical and legal reasoning and critical reflection are natural and integral components in their clinical decision making practice.
6. Enable students to understand that ethical and legal issues arise in everyday practice.

To achieve this, the following curricular recommendations are made:

1. Ethics and law should be introduced systematically to prepare students to meet their own professional and legal responsibilities when working with patients.
2. It should be a feature of the whole medical curriculum, be introduced early and be fully integrated with the rest of the curriculum. It should have sufficient curricular time and resources allocated to achieve its goals.
3. It should be formally assessed as with other core subjects within the curriculum.

It is recommended that "a variety of teaching methods be used, ideally including a mix of large and small groups, case-based discussions, and teaching that is made clinically relevant" (Goldie, Schwartz & Morrison, 2003, p. 469).

The overall conclusion of the authors' study regarding medical ethics curriculum on first year students indicated that medical students wanted more emphasis on context. "The current trend in both medical ethics education, and in bioethics theory research, is towards increased attention to context" (Goldie, Schwartz & Morrison, p. 2003, 473). In their evaluation of the medical ethics

curriculum, they identified effectiveness factors, as well as factors, which distracted from the goals or outcome of the curriculum. It is the authors' position that the results from this study will help in future development of the medical ethics course (Goldie, Schwartz & Morrison, 2003).

2.2.2 Ethics in Accounting and Business Curricula

The Association to Advance Collegiate School of Business International (AACSB) regulates and dictates most Business Schools' academic standards. The AACSB stresses the importance of ethics in the business curriculum (Mantzke, Carnes, & Tolhurst, 2005). The emphasis of ethics in the accounting curriculum is important to the student (future professionals) and the constituencies they will serve in the future (Mantzke, Carnes, & Tolhurst, 2005). The accounting curriculum has developed a framework in which students have practical applications of ethics in real-life situations. According to Mantzke, Carnes & Tolhurst (2005), this framework has two components:

I. A Decision-Making Approach

- Check the facts.
- State the problem.
- Identify the morally relevant factors.
- Develop a list of alternative solutions.
- Test the alternatives: evaluate the alternatives against the benchmarks of relevant professional and moral standards of conduct.
- Choose the best alternative.

II. Modular Approach

- Entails four (4) 50-minute class sessions
- Week 2 – Introduction of basics of ethics module
- Week 4 - Instructor evaluation of information requests
- Week 5 - Instructor responses to requests
- Week 9 - Student groups make a formal recommendation to the stakeholder
- Week 12- Student groups receives a written critique of its recommendation from another group

According to the authors, this framework is currently a work in progress. The authors concede, "…it is impossible to know what impact teachers have on their students' future ethical behavior; however they believe ethics should be an integral part of an accounting curriculum" (Mantzke, Carnes, Tolhurst, 2005, p. 5).

2.2.3 Ethics in the Legal Curriculum

Ethics is a central component in the legal curriculum. However, many professionals and academics in the legal area believe that the curriculum leaves much to be desired in regards to ethics instruction. The arguments are not about the inclusion of ethics in the curriculum, but how to teach ethics to students. A Professor of Law at Sydney Law School in Australia indicated this point by commenting on the lack of applied learning. "Universities needed to focus more on 'professional ethics, dispute resolution, negotiations, client interviewing, working with teams [and] having a greater identification with client interests', Professor Weisbrot told the HES" (OKeefe, 2004, p. 34). There are further debates regarding the pedagogical structure of ethics in the legal curriculum.

> There has been some concern about the growing disjunction between legal education and the legal profession. While the law schools seem to be moving toward pure theory, the firms are moving toward pure commerce, and both have abandoned the middle ground -ethical practice (Edwards, 1992, p. 34).

It is the consensus of legal scholars and practitioners that students are acclimated to the application of ethical principles in law. In doing so, law students will be more adapt in the interpretation and modification of legal doctrine and precedents in the law.

> It is believed that a good "practical" scholar gives due weight to cases, statutes, and other authoritative texts, but also employs theory to criticize doctrine and to propose changes in the law. Law students need concrete ethical training. Both academicians and practitioners have a joint obligation to serve the justice system. A survey was circulated to former law clerks, asking them to reflect on the connection between their own education and practice. Results indicated that individual lawyers retain some power and responsibility to assume their appropriate roles (Edwards, 1992, p. 34).

Each of the above discussions presented both problems, as well as solutions, involving the incorporation of ethics in curricula. However, in each situation the importance of ethics to the curriculum was clearly stated. The next section evaluates the description of computer ethics.

2.3 Computer (or Cyber) Ethics

Ethics, when applied to technology-related issues, is also recognized as cyberethics. Cyberethics is defined as ethical quandaries with a technological dimension (Spinello, 2003). There is a plethora of viewpoints regarding the subject of cyberethics (Scharff & Dusek, 2003). For instance, one major question that many professionals within and without the computer community consider: *Is cyberethics different from "regular" ethics?* Regular ethics is defined as ethics that apply across all contexts (i.e., medical, legal, business, and religious). In some instances, this question can be answered with a definite yes. However, many theorists would state that there are differences between regular ethics and computer ethics. They base their arguments on the fact that computer ethics is based on the impact of computing technologies on individuals and society. Johnson (1984) indicated that society has moved from "being a service-oriented society to a computer dependent society" (Johnson, 1984, p. 23). However, this does not indicate that computing technologies have introduced new ethical issues. Therefore, some would argue that there are no differences between regular ethics and computer ethics. Their arguments are based on the fact that computing technologies only bring a new dimension to existing ethical issues. Ethics is also defined as making a choice between right and wrong in a situation that involves a dilemma (Pence, 2000). This definition of ethics can be applied to anything including circumstances involving computer technology (Johnson, 2001, p. 4).

A major problem is the practice and application of ethics in computing environments by computing professionals.

> In the computing culture, professionals and organizations put emphasis on proper or improper design procedures and practices. While this is definitely important, increasing awareness of the ethical behavioral practices of the computing professional and organization is becoming crucial. Computing technology is pervasive in all areas of employment; therefore, when considering ethical practices, this component should not be omitted. Computing professionals and organizations are not different species. However, the ethical practices of computing professionals and organizations are becoming suspect in the light of computer crimes, i.e., fraud, identity theft, embezzlement, etc, (Dudley-Sponaugle & Lazar, 2005, p.164).

Regardless of their views or positions, most ethicists and computer scientists would agree that ethical education and practice is important. The issue for many is how to connect ethics education and practice. The next sections describe the computing curriculum, the implementation of ethics in the computing curriculum, and the pedagogical structure of the ethics course that is part of this study.

2.4 Computing Curriculum – Background

Computer technology has continually and rapidly changed and advanced in the last two decades. The impacts of these rapid changes are affecting the computing curricula. "Computing has become a diverse and multi-faceted discipline. It is imperative that computing curricula evolve so that they will effectively convey this

breadth" (Goldweber, M., Impagliazzo, J. Bogoiavlenski, I., et al., 1997, p. 94). As these changes are affecting the computer curricula, the focus is under new scrutiny.

One of the fundamental changes in computer science in the last decade has been the realization that the context in which technology is used must be taken into account in its design, partly because of the ethical implications of its use and partly because understanding the context of use helps inform and improve the design (Martin, 1997, p. 114).

The increased importance of this situation has been recognized in the computing curriculum. However, the changes in the curriculum do not necessarily respond to the changes in the technology. "Other considerations are that IT changes can't happen overnight and that there is administrative red tape with which to contend; additionally, sometimes there is resistance to change from established faculty who don't wish to expend the time and energy to learn newer technologies" (Insabelle & Fogle, 2005, p. 151).

2.5 Ethics Integration in the Computing Curriculum

The application of ethics to computer technology is becoming an essential topic to include in computing curricula (Edgar, 2003). In the early stages of development, the computer ethics curriculum was an incorporation of math, science, and engineering processes. According to Martin (1997), the hybridization of these courses gave a new definition to computer science education. In addition, Martin stated that the areas of social, ethical, and professional issues were "not defined as a separate subject area, but as a context within which the rest of the curriculum would

sit" (Martin, p. 1997, 114). In conjunction with this new approach to computer science education, CC91 (a joint task force of the ACM and IEEE Computer Society) believed that a graduate of a computer science program should have the following: "Undergraduates need to understand the basic cultural, social, legal, and ethical issues inherent in the discipline of computing…Future practitioners must be able to anticipate the impact of…a given product" *(ACM/IEEE Computer Society Joint Curriculum Task Force, 1991)*.

Martin (1997) stated that the CC91 initiative "fell short in providing sufficient detail and guidelines about how to do this" (Martin, p. 1997, 114). Two years after her 1997 article, Martin and Weltz (1999) reported on the impacts of the CC91 initiative on the computer science curriculum. According to the authors: "Experts in the field of computer ethics and social impact have stated that there is a significant difference between being made aware of ethical and social impact issues as a student and becoming a socially responsible, ethical professional" (Martin & Weltz, 1999, p. 6). The authors stated that there exists a gap between providing educational experiences and indoctrination (Martin & Weltz, 1999).

The challenge for the computer science curriculum is to narrow the gap in order to provide an effective and productive ethical context. "The ACM Curricula 2001 has listed 'computer science ethics' as one of the bodies of knowledge in the undergraduate degree in computer education. However, it is up to the individual institutions on how to implement it (Ghafarian, 2002, p. 180). As stated earlier in the paper, the mandate from the accredited bodies to include ethics in the curriculum provides several diverse approaches on how to do this. In addition, there is literature

that responds to the various and numerous challenges of teaching computer ethics (Grodzinsky, Gehringer, King, & Tavani, 2004).

2.5.1 Ethics Curriculum Development

There is the question of whether computer ethics should be a separate course or integrated in several courses in a computer science curriculum. There are several theories on how this should be done.

Martin (1999) indicated that early introduction of ethics and social impacts in levels 1 and 2 computer science courses are crucial to future discussions in other CS courses. Greening, Kay & Kummerfeld (2004) stated that integration of ethics in the curriculum has become the "preferred option of treatment of ethical dimensions in computing" (Greening, Kay & Kummerfeld, 2004, p. 91). They listed the following challenges raised by the demand to include ethics in the computing curriculum:

1. The integration of ethical content into technical units:
2. Empowerment of staff in teaching ethical content;
3. Engaging students with ethical issues;
4. Facilitation of valued learning of ethical content; and,
5. Doing justice to the content (Greening, Kay & Kummerfeld, 2004, p. 91).

Dr. Miller (2004) looks at the plausibility of incorporating ethics into the computing classroom. He states that the following issues should be considered:

- "The [computing] curriculum is already overcrowded. Including ethical issues requires that important technical issues be ignored or given less attention than they should be given.

- Computer science faculty have little experience in ethics, and they are uncomfortable teaching in this area.
- Professors unschooled in formal ethical techniques may fall into the trap of preaching a moral code (an abuse of their position) instead of raising questions, elaborating possible answers, and exploring justifications (activities which properly belong to ethics).
- Any ethics taught will be diluted at best and possibly erroneous" (Miller, 2004, p. 5).

Another position in considering ethics in a computing curriculum is to introduce it as a new subject area. The area of computing has introduced new ethical situations and that has an impact on the field of philosophy. Many philosophers believe that there is an intersection of philosophy and computing. Moor and Bynum (2002) introduced the term *cyberphilosophy* to designate this intersection. "Cyberphilosophy came into its own during the twentieth century as a result of the formulation of the theory of computing by Alan Turing and Norbert Wiener, and by the development of increasingly sophisticated computers, software, and networks" (Moor and Bynum, 2002, p. 1).

2.5.2 Faculty Teaching Ethics

Computer science faculty are accustomed to working in situations where they know the answers that the student should provide on an exam—either the answer is right or wrong. There is little credit given for the method of obtaining the result, especially if differing results are appropriate. Some faculty members are not convinced that computer ethics should be a part of the curriculum because they feel

that it is their obligation to teach students how to be productive workers in their profession, but ethics is not a part of their job.

Greening, Kay & Kummerfeld (2004) believe that faculty can be empowered to teach and incorporate ethical content within their area of expertise. The authors suggest that faculty who experience uncertainty in teaching ethics, or what to teach, can start at an obvious point, professional codes of ethics. However, the authors state that using professional codes of ethics as a pedagogical tool is "useful but insufficient" (Greening, Kay & Kummerfeld, 2004, p. 92).

Another approach in getting computing faculty interested in teaching ethics is to hold training sessions and workshops. "The *Developing On/Off-line Computer Ethics* (DOLCE) is an NSF sponsored project which held three summer workshops for university faculty members. DOLCE has created web-based materials for teaching computer ethics to undergraduate computer science majors" (Moskal, King, Miller & Camp, 2003). The DOLCE Project's main emphasis was on improving instruction of computer science students in regards to computer ethics (Moskal, King, Miller & Camp, 2003). The project identified several web-based resources for students and professors. "The DOLCE project maintains a publicly accessible web site for teachers and students interested in computer ethics [Available at: http://csethics.uis.edu/dolce/]. This site features teaching materials developed by workshop participants, links to other computer ethics sites, and a computer ethics contest for students (Moskal, King, Miller & Camp, 2003).

While training computer science faculty is one option, another option is soliciting others to teach the ethics course. Greening, Kay & Kummerfeld (2004)

support bringing in professional or academic philosophers to teach ethics in the computer curriculum. However, there are positions against this approach. Gotterbarn (2000) argues that although the philosophical foundations of ethics may require deep commitment before they become accessible, the practical applications are relatively manageable.

Some suggest that engaging an ethicist to manage ethical content runs the risk of suggesting to students the fruitlessness of ethics education. Martin & Hotz (2002) note: "If a specialist is required to introduce ethics content in a computing course, it sends the message that the issue of ethics exceeds the capacity of a computing professional given the students' academic experience that a computing teacher is unable to embrace it" (Greening, Kay & Kummerfeld, p. 2004, 92).

Teaching computer ethics involves many factors and can be a complex undertaking by computer science faculty. Whether the faculty is new or experienced, it is very helpful to have collegial discussions about what has worked, share thoughts and ideas, and review materials together. Sometimes co-teaching or observing classes can be mutually beneficial for new and experienced faculty. Collegial support can be profitable for faculty teaching ethics and beneficial for the student taking these courses (Pulliam, 1992; Dudley-Sponaugle & Lidtke, 2002).

2.5.3 Available Resources for Ethical Instruction

Resources to assist in teaching computer ethics have been developed over many years. ACM SIGCAS contributed much of the early material. Computing Professionals for Social Responsibility (CPSR) has a long history of contribution to curricula and resource materials [Available at: www.cpsr.org/program/education/educ.html].

These two groups continue to provide valuable resources for the new and the seasoned faculty member. The Risks Forum, written by Peter Neumann, in Communications of the ACM, provides a rich source of problems within the field.

Today, much of the material needed to teach computer ethics is available on the web. Examples of online resources include: www.onlineethics.org and www.ethics.ubc.ca/resources where items such as courses, lists of textbooks, organizations, decision-making tools, and publications are available. Other sources of reference are the web pages of individuals who have established a record in the field for example (http://uis.edu/~miller) is rich in instructional material for computer ethics courses and for faculty. In addition, the site http://www.iit.edu/departments/csep/eac_workshop/eac/index.html provides information for those who prefer to integrate the teaching of ethics across the curriculum.

2.5.4 Ethical Theories

Ethical theories can assist students in moral deliberations and decision-making regarding computing technologies. Tavani (2007) states several bases for using ethical theories in the application of decision-making:

1. An essential feature of theory in general is that it guides us in our investigations.
2. In science, theory provides us with some general principles and structures to analyze our data.
3. The purpose of ethical theory, like scientific theory, is to provide us with a framework for analyzing moral issues.

4. Ideally, a good theory should be coherent, consistent, comprehensive, and systematic.
5. To be *coherent*, the individual elements of the theory must fit together to form a unified position.
6. For a theory to be *consistent*, its component parts cannot contradict each other.
7. To be *comprehensive*, a theory must be able to apply broadly to a wide range of actions.
8. Moreover, to be *systematic*, the theory cannot simply address individual symptoms peculiar to specific cases, while ignoring general principles that would apply in similar cases.

Computer ethics courses are primarily focused on applied ethics rather than theoretical ethics. There are three different perspectives of applied ethics used in computing: professional ethics, philosophical ethics, and descriptive ethics.

"*Perspective #1: Cyberethics as a Field of Professional Ethics* – This field is best understood as identifying and analyzing issues of ethical responsibility for computer professionals. The issues considered from this perspective are focused on the computer professional's role in designing, developing, and maintaining computer hardware and software systems.

Perspective #2: Cyberethics as a Field in Philosophical Ethics – This field uses philosophical methods and tools to analyze issues involving professional ethics.

Perspective #3: Cyberethics as a Field of Descriptive Ethics – This field describes aspects of moral systems and reports how various groups and cultures interpret or view these moral issues (Tavani, 2007, pp. 13-19).

Table 3, below, presents the associated disciplines and issues pertaining to each perspective (Tavani, 2007):

Table 3. *Summary of Cyberethics Perspectives*

Type of Perspective	Associated Disciplines	Issues Examined
Professional	Computer Science Engineering Library/Info Science	Professional Responsibility System Reliability/Safety Codes of Conduct
Philosophical	Philosophy Law	Privacy & Anonymity Intellectual Property Free Speech
Descriptive	Sociology Behavioral Sciences	Impact of cybertechnology on governmental/financial/ educational institutions and socio-demographic groups

While this information can give some basis for the pedagogical development of an ethics course, there is little to no agreement or consistency regarding which philosophical theories to include in computer ethics courses. A major problem is that it is not possible to cover all theories; therefore, each program or faculty member needs to decide which group of theories to use. It is important that students become aware that there are many ethical theories and that the course will cover only a few. One of the considerations when choosing a text is to select one that covers the

theories you want to present in your courses. Otherwise, you will need to take considerable time to clarify for students what is in the text and what you are asking them to use in the course.

After researching the various literature and resources, the researcher found no consistency in which ethical theories to use in her computer ethics courses. The researcher decided to generate a list of theories she felt were important for students to use in analyzing the ethicality of their decisions. The researcher feels that incorporating the varieties of these theories will assist students in developing an understanding of how to use them to support their positions. The following are ethical theories chosen by the researcher that are covered in her ethics courses: Consequentialism/Utilitarianism, and Deontological theories. In addition, Kant's Categorical Imperative, a philosophical principle, is covered in the course.

These ethical theories have worked well for many computer professors teaching computer ethics (Johnson, 2002). It should also be noted that these theories and principles are prevalent in the majority of the computer ethics and philosophy courses taught at colleges and universities today. The following discussion briefly describes the philosophical theories and principle:

According to Hallgrath (1998), the term teleology is derived from Greek words, which means *end* or *goal*, and *logos*, which means *science*. Consequentialism is a theory of right action that holds that the rightness of an action depends on the consequences of that action. The consequentialist chooses a decision on the best ends or goals that an action brings about. For the Consequentialist, one can determine how one ought to act based on the likely outcomes of the courses of action open to one.

Utilitarianism is a level of Consequentialism. When our actions benefit others as well as ourselves, we are operating in the public interest. This approach embodies the principle of utilitarianism, which helps a person judge, through a form of cost/benefit, pleasure/pain, or happiness/unhappiness analysis, whether an action is ethical (Quinn, 2004, p. 67). The utilitarian focuses on the outcome that yields the maximum good for the group and least harm for the group. "The decision procedure commonly followed by utilitarians (a type of consequentialist) requires them to predict alternative actions available to them in a particular situation. An act is good if it produces good consequences, or at least a net excess of good consequences over bad." (Maner, 2004, p. 54)

Theories that emphasize the rights and duties of individuals over the consequences of particular actions fall into the category of deontology. The most influential of the Deontological theories is attributed to the German philosopher, Immanuel Kant, who "made respect for persons the central concept in his ethical theory. Because human beings are rational beings, said Kant, they have worth in themselves and do not need anything outside of themselves to give them worth" (Bynum, 2004, p. 72).

The word deontology comes from the Greek work *deon*, which means duty. "Deontology holds that the rightness of an act is derived from its logical consistency and universalizability. Deontological ethics famously holds that the right thing is obligatory without regards for consequences." (Pence, 2000, p. 14)

Kant's Categorical Imperative is a deontological moral principle. Kant provides different statements of the Categorical Imperative. For present purposes, the

following are the most relevant: (1) "One ought always to act on those maxims which one can at the same time will be universal laws"; and, (2) "One ought always treat humanity, whether in one's own person or in that of another, never merely as a means but always as an end in itself." In other words, at the basis of Kant's ethical view are two values: consistency and respect. The principles of consistency and respect are applied to judge whether an action is ethical (Rachels, 1986).

The category of theories addressing the meaning of right and wrong and the interpretation of right and wrong is called Meta ethics. Theories that fall under this category are relativism and objectivism. Relativism theory presents that there are no universal moral norms of right and wrong in ethical decision-making (Quinn, 2004). There are two main categories of relativism:

- Cultural Relativism – "This category of relativism is based on the position that all moral definitions and interpretations are culturally based. It is the view that all cultures have different value systems and each value system is correct for its culture" (Edgar, 2001, p.41).
- Subjectivism – "This category of relativism holds that each person defines and practices what is right and wrong for him or herself" (Quinn, 2004, p. 53).

In addition, the researcher briefly covers the following theories in her ethics courses: Virtue Ethics, Social Contract Theory, and Divine Command Theory.

The researcher developed a methodological approach for students to apply these ethical theories to issues involving computing technologies.

Philip Brey (2000) describes the 'standard methodology' used by philosophers in applied ethics research as having three stages:

1) Identify a particular controversial practice *as* a moral problem

2) Describe and analyze the problem by clarifying concepts and examining the factual data associated with that problem;

3) And, apply moral theories and principles to reach a position about the particular moral issue (Tavani, 2007, p.16).

The theories, identified by the researcher, are applied using an analytical tool to help students support and justify their ethical decisions. This analytical tool is identified as the Four-Step Analysis Approach. (Copies of the analysis approach worksheet is in Appendix C). This analytical tool is combination of Kallman's & Grillo's (1996) Approaches to Ethical Decision Making and the researcher's creation of the four steps. The four-step analytical tool assists the student in decision-making by:

- Identifying the situation, which states the relevant facts, list the ethics that are in questions from the facts and list all stakeholders involved in the situation.
- List several statements or questions that are ethical dilemmas from the situation.
- Isolate the major ethical dilemma from the situation.
- Analyze the ethicality of both alternatives (yes or no) to the identified major ethical dilemma: from the Consequentialist, Deontologist, and Kantian perspectives.
- Interpret the outcome from each philosophical analysis
- Choose and justify the philosophical theory that best applies to the situation.
- Explain their decision and list specific steps needed to implement their defensible ethical decision.

- Propose what long-term changes would prevent the identified ethical dilemma in the future.

2.6 Structure of an Ethics Course

This section describes the elements of the researcher's courses. The course description is important in that is gives an outline of course content. The researcher defines her three-credit ethics course as follows: This course is designed to help students deal with societal and ethical issues as professional computer scientists or as knowledgeable users. Ethical matters involving the delicate balance of information and technology in our society will be closely examined. Students will become more aware of ethical issues involving computer technology in applied areas as well as those arising from design and development of software. The affect of computer usage on the human condition in society will be discussed, with examples taken from several areas of application. Topics in intellectual property rights will be covered, as well as privacy issues, computer crimes, and legislation regarding computer technology. Professional activities in computing to be studied include professional and corporate standards, codes of ethics and good practice, and certification and licensing of computing personnel.

The researcher defines her one-credit ethics course as follows: This course is designed to prepare students to deal as professionals with the social and ethical issues in the computing sciences. In addition, students will become aware of the broader applications of computers and the implications of these applications. (Copies of both course outlines are in Appendix D.)

2.6.1. Identifying Goals and Objectives

Distinguishing the goals and objectives helped integrate the various resources in course development of the two ethics courses. To evaluate which resources would be appropriate, the researcher's first approach was to identify the goals and objectives for the computer ethics courses. The goals and objectives identified for this course include: students' ability to appreciate ethics as applied to computing technologies and students' ability to analyze and debate ethical issues using a structured problem solving approach.

2.6.2 Subject Areas Covered in a Computer Ethics Course

This is a very rich field and certainly, during a regular semester it is not possible to cover all of the topic areas. Some of the topics covered in the ethics courses are: ethical principles, professional codes of ethics, intellectual property, privacy, computer abuse, risks, and social and global issues (Dudley-Sponaugle & Lidtke, 2002).

Using the information from the following resources: *ISCC '99: Educating the Next Generation of Information Specialists in Collaboration with Industry* [Available at: www.iscc.unomaha.edu] and the *NSF 2001 DOLCE Workshop* and the departmental course outlines, the researcher identified the following major areas to be covered in the three credit and one-credit ethics courses:

1. Methods of Ethical Reasoning
    a. Approaching the Subject of Ethics
        i. Managing Ethical Discussion
        ii. Philosophy, Religion, and Ethics
        iii. The Existence of Right and Wrong

iv. The Subject of Moral Analysis
v. The Role of Codes of Ethics

b. Ethics and Ethical Decision Making
i. Definition of Ethics
ii. Competing Factors that Affect Our Behavior
iii. Computer Ethics and Regular Ethics

c. Approaches to Ethical Decision Making
i. Relativism, Social Contract Theory, Divine Command Theory, Virtue Ethics, Value Judgment
ii. Law and Ethics
iii. Utilitarianism, Deontology, and Kant's Categorical Imperative

2. Intellectual Property Rights
3. Computer Crimes
4. Privacy and Security Issues
5. Professional & ethical responsibilities

2.6.3 Measuring Student Outcomes

Through case studies, homework and online assignments, and in-class discussions, students will gain valuable skills and knowledge. Through these assignments, students will gain analytical and problem-solving skills, be able to draw reasonable inferences from observation, develop the ability to synthesize and integrate information and ideas based on a holistic approach, and be able to distinguish between fact and opinion. These assignments are defined as follows:

Homework Assignments

The student is expected to complete essay questions assigned by the instructor. The essay questions are from the textbook and/or handouts. The homework assignments are collected and graded. This assignment fulfills the objectives of the course to evaluate student's abilities to identify ethical issues, analyze ethical issues

using a structured problem solving approach, and demonstrate knowledge by using the problem solving approach or critical thinking.

In-Class and Online Discussions

The majority of class time involves discussing relative ethical issues and concerns, based on assigned readings, in-class and online activities, and homework assignments. Students should participate in class fully by attending all classes and contributing to the discussions. In addition, these discussions are conducted online through Blackboard via the Discussion Board. These assignments fulfill the objectives of the course to evaluate student's abilities to identify ethical issues, analyze ethical issues using a structured problem solving approach, debate the position of the ethical issue identified, illustrate the value of ethics in making decisions about computer technology, and demonstrate knowledge by using the problem solving approach or critical thinking.

Case Study Projects

Students are required to work on three major case studies. The case studies are taken from current ethical situations involving computing technology. The case studies allow the students to explore current ethical problems and opportunities within computer information and technology. Each case study is evaluated in terms of a completed analysis form and submitted paper, as a result of the analysis. These projects fulfill the objectives of the course to evaluate student's abilities to identify ethical issues, analyze ethical issues using a structured problem solving approach, debate the position of the ethical issue identified, illustrate the value of ethics in

making decisions about computer technology, and demonstrate knowledge by using the problem solving approach or critical thinking.

Final Paper

Each student is required to submit a 10-page paper on a case (of choice) of an ethical issue. This paper appraises the student's knowledge and comprehension of ethical issues within the context of computer technology, evaluates the student's ability for critical thinking, and measures the result within written context. The final paper fulfills the objectives of the course to evaluate student's abilities to identify ethical issues, analyze ethical issues using a structured problem solving approach, debate the position of the ethical issue identified, illustrate the value of ethics in making decisions about computer technology, and demonstrate knowledge by using the problem solving approach or critical thinking.

The goals of the case study and final paper analysis are: 1) To appraise the student's knowledge and comprehension of ethical issues; and, 2) To evaluate the student's ability to think critically about ethical issues.

In assessing the Case Study Projects and Research Paper, students must: Illustrate the ethical issues involved in the case; analyze the ethical issues using an ethical decision making process; and debate their position on the ethical issues raised in the case. The researcher created a rubric to assess a grade for all case study and final papers (See Appendix E).

The grading method is a measurement tool used to assess students' products from the assignments. The grade breakdown of course requirements is as follows:

Case Study Projects	30%
Final Paper	25%
Participation (online & in-class)	15%
Homework	10%
Online Assignments	20%
Total	100%

The different measurements of students' outcomes from the ethics course gave the researcher some indication on the results of the pedagogical structure.

2.7 Conclusions and Summary

This chapter provided a review of literature on the topic of ethics, ethics in various curricula, ethics in the computing curriculum, and structure of the researcher's ethics course and model of ethical decision-making. This chapter highlighted literature that showed the various implementation processes of ethics in other curricula. The researcher investigated the emergence of computer ethics and provided discussion on the integration of ethics in the computing curriculum.

While past research focuses on the integration of ethics within a computing curriculum, there is very little research on ethics in the computing curriculum. There is significant lack of information on ethics course development, student awareness of ethical issues in computing and student perceptions of computing ethics courses. Chapter 3 addresses the research methodology of this study.

Chapter 3: Research Methodology

Overview

- Review of the Research Purpose, Goals and Structure
- Research Questions
- Research Hypotheses
- The Study
  - Description of Population
- The Instruments
  - Measurement and Operationalizing the Variables
  - Survey Pilot Testing
- Data Collection Procedures
- Statistical Procedures/Methodology
- Summary

3.0 Review of the Research Purpose, Goals, and Structure

The purpose of this research is to study students' perceptions of ethics as it relates to computing. This study assesses these perceptions from an ethics course content and structure. Students' perceptions are based on their experiences with the course content and application.

This chapter presents the research methodology that is used in the study including a description of the sample/population, the instrument used, data collection procedures, statistical procedures used, and a summary.

Based on the purpose of this study, the following research questions are formulated.

3.1 Research Questions

1. How will students perceive ethics after being exposed to a structured analysis approach (a four-step analysis decision-making tool)?

2. How do students' perceptions of the importance of ethics in computing practices change after being exposed to a computer ethics course?

3. How do students perceive the ethics course pedagogy after taking the course?

3.2 Research Hypotheses

The following research hypotheses are derived from the above research questions:

1a. Students' (computing and non-computing majors) perceptions of ethics will increase after using the four-step analysis decision-making tool.

1b. Perception of decision-making abilities will be different between computing majors and non-computing majors after using the four-step analysis decision-making tool.

2. Students' (computing and non-computing majors) perceptions of the importance of ethics regarding computing practices will change after taking the ethics course.

3. Students' (computing and non-computing majors) view of ethics in computing will change after exposure to the course pedagogy.

3.3 The Study

The study is conducted at University X. The University is located eight miles from the heart of Baltimore and about an hour from Washington, D.C. The suburban location is ideal for students with and without transportation. The campus

is set in a woodsy context but is close to Baltimore and Towson city life. University X has a "small-school" feel with "big-school" choices. The main draw to University X is the student-faculty ratio, which is 17 to 1. More than 14,000 students attend the University. These students are from over 100 foreign countries and all over the United States. University X offers 64 majors, which are located under the following colleges: Business and Economics, Education, Fine Arts and Communication, Health Professions, Liberal Arts, Science and Mathematics, Graduate Education, and Research and Extended Programs.

The Department of Computer and Information Sciences is located in the College of Sciences and Mathematics. The Department of Computer and Information Sciences (COSC) offers the following undergraduate programs of study: a Bachelor of Science in Computer Science; a double major in Computer Science and Mathematics; a Bachelor of Science in Computer Information Systems; a double major in Computer Information Systems and Business Administration; a minor in Computer Science; a minor in Computer Information Systems. COSC recently introduced a new track of study, Computer Security, under the existing Bachelor of Science in Computer Science program. The major in Computer Science and the double major in Computer Science and Mathematics are both accredited by the Computing Accreditation Commission of ABET. In addition, the Department of Computer and Information Sciences offers the following graduate programs of study: Master of Science in Computer Science with three tracks: Computer Security Track, E-Commerce Track, Software Engineering Track, and a Doctor in Science in Applied Technology.

The two main undergraduate programs are identified as COSC (for Computer Science) and CIS (for Computer and Information Systems). The learning objectives of the two main undergraduate programs listed in this department are identified as follows:

COSC Program Learning Objectives

- Students can use their proficiency in theoretical and applied computing principles and practices to solve a variety of problems.
- Students can explain the theoretical and applied principles that underlie computer science.
- Students will understand the ethical and societal concerns and dilemmas facing computer scientists and can formulate appropriate solutions and courses of action.
- Students can work effectively in teams and communicate effectively.

CIS Program Learning Objectives

- Students can use their proficiency in information systems principles and practices and quantitative analysis to solve a variety of problems.
- Students can explain the quantitative and business principles that underlie information systems.
- Students will understand the ethical and societal concerns and dilemmas facing information systems professionals and can formulate appropriate solutions and courses of action.
- Students can work effectively in teams and communicate effectively.

3.3.1 Description of the Population

The population for the study was students from the instructor's sections of Ethics and Societal Concerns for Computer Scientists (COSC 418) and Senior Seminar: Professional Ethics (COSC 480) courses during the fall and spring semesters. The classes are different, in that, COSC 418 is a three-credit course and COSC 480 is a one-credit course. The Department of Computer and Information Science has offered at least two to four sections of COSC 418 and one section of COSC 480 each semester. The prerequisites for COSC 418 are: two science courses or one math course and one science course. There are additional recommended courses, including a previous computer course and an upper-level English course. COSC 418 counts as a major requirement for Computer Science and Computer and Information Systems students. In addition, the course counts as a general education requirement course under the II.A.2 category titled Science and Technology Category, which means it is open to any students in any major at University X. The prerequisites for the COSC 480 class are: that the students must be in Senior-standing and a COSC or CIS major.

3.4 The Instruments

The instruments used in this study are pre and post evaluation surveys. The instruments used in this study were originally developed and used in a pilot study by the researcher at University X. The surveys are a combination of questions created based on the researcher's experience in teaching computer ethics for more than five

years and knowledge obtained through several research method courses (30%) and questions (70%) from a pre-existing instrument created by the DOLCE (Developing Online/Offline Computer Ethics) Project sponsored by the National Science Foundation. The main emphasis from DOLCE Project was on improving computer ethics instruction to computing students.

In using the DOLCE Project as a basis for prior study in this area, there are indications that computing students are aware of ethical issues or problems concerning computing technology. The DOLCE pre and post evaluation surveys were administered to computer faculty and students only. The purpose or goals of the pre- and post- evaluation surveys were to assess increased awareness in computer ethics. Approval was granted by Dr. Miller to use questions from the DOLCE Computer Attitude Survey on the pre and post evaluation surveys (Moskal, King, Miller & Camp, 2003).

The pre and post evaluation surveys are separated into five sections (see Appendix B).

- The first section contains demographic information, i.e., gender, course, ethnic background, major, semester, and year taking the ethics course, and student's ranking (level of college experience).
- The second section contains an exercise where the student is asked to rank the importance of 10 computing courses from "1" indicated the most important course to "10" indicated the least important course. The listed courses were: Artificial Intelligence, Data Structures, Database, Distributed Computing, Ethical Issues in Computing, Finite Automata, Graphics, Operating Systems,

Software Engineering, and Testing and Reliability (Moskal, King, Miller & Camp, 2003).

- The third section contains questions, using a five-point Likert scale, asking the student to do the following: rate their awareness of ethical issues before taking the ethics course; choose the area of importance in regards to ethical issues; identify their ability to make an ethical decision, choose whether or not ethics is relevant in a computing major; and, a non-Likert question: state the reason for their selecting the ethics course.
- The fourth section contains a scenario where the student selects options that they feel apply to a particular situation of the scenario. The respondents were asked to imagine they are in this situation. They are then presented with a list of 12 reasons that support either going or not going to the department head's boss. Respondents were asked to rank the extent to which each of the presented reasons would influence their final decision using the following categories: "No impact on my final decision", "Slight impact on my final decision", "Strong impact on my final decision", and "Very strong impact on my final decision" (Moskal, King, Miller & Camp, 2003).
- The fifth section contains an exercise where the student is asked to distribute $1 million dollars among several categories involving computing technologies. The respondents are asked to imagine they were in charge of a new NSF division and had the opportunity to award $1,000,000 in grants. Proposals of similar quality were submitted in the following areas: Algorithms, Artificial Intelligence, Commercial Off-The-Shelf Software,

Databases, Formal Methods in Computer Science, Image Processing, Networking, Programming Languages, Robotics, and Social and Ethical Issues in Information Technology. Assuming the same number of grant applications were submitted from each area, participants were asked to determine how much of the $1,000,000 should be awarded to each area (Moskal, King, Miller & Camp, 2003).

- On the pre evaluation survey, there is section where students are asked to choose the reason they selected the ethics course.

The questions on the surveys, developed by the researcher of this study, are based on course content and will require students' responses from their experiences before and after taking the ethics course. These questions ask students to rate their awareness of ethical issues after taking the course, choose the area of importance in regards to ethical issues, identify their ability to make an ethical decision, identify if the ethics course assisted in becoming aware of ethical issues, identify whether or not the structured analysis approach assisted in formulating ethical decisions, choose whether or not ethics is relevant in a computing major, rank class exercises, and choose an activity that they enjoyed the most.

The format differences in the pre and post evaluation surveys are the following:

- The format of the pre evaluation questions is in different order and placement from the post evaluation questions.
- There is one question that appears only on the pre evaluation survey (i.e., the reason for selecting the ethics course).

- There are specific questions that appear only on the post evaluation survey, which are not on the pre evaluation survey due to student's lack of exposure to course content. The following is a list of question content found only on the post evaluation survey: identify if the ethics course assisted in becoming aware of ethical issues, identify whether or not the structured analysis approach assisted in formulating ethical decisions, rank class exercises, choose an activity that they enjoyed the most, and would they use the four-step approach after taking the course.

Research questions #1 and #2 and hypotheses #1 and #2 are focusing on questions repeated in both the pre and post evaluation surveys. Research question #3 and hypothesis #3 are focusing on questions contained only on the post evaluation survey. On the next page, table 4 illustrates the research questions, the associated hypotheses, and the related survey questions.

Table 4. *Research Questions, Associated Hypotheses, and related Survey Questions*

Research Questions	**Research Hypotheses**	**Survey Questions** (See Appendix B)
1. How will students perceive ethics after being exposed to a structured analysis approach (a four-step analysis decision-making tool)?	**1a. Students' (computing and non-computing major groups) perceptions of ethics will increase after using the four-step analysis decision-making tool.** **1b. Perception of decision-making abilities will be different between computing majors and non-computing majors after using the four-step analysis decision-making tool.**	**This question is found on the Post Survey only:** Did the structured analysis approach used in this course assist you in formulating your ethical decision? **These questions are found on both the Pre and Post Surveys:** Rate their awareness of ethical issues; Choose the area of importance in regards to ethical issues; Identify their ability to make an ethical decision; Choose whether or not ethics is relevant in a computing major
2. How do students' perceptions of the importance of ethics in computing practices change after being exposed to a computer ethics course?	**2. Students' (computing and non-computing major groups) perceptions of the importance of ethics in computing practices will change after taking the ethics course.**	**These questions are found on both the Pre and Post Surveys:** Before/After taking this course, I would rate my awareness of ethics in computer technology as: Before/After taking this course, identify the importance of ethics in computing Which area of computer ethics do you feel holds the greatest amount of ethical dilemmas for the computer professional? Rank a list of courses from 1 to 10 **Note: This is where the two scenario exercise and distribution of monies exercise would fit in.**
3. How do students perceive the ethics course pedagogy after taking the course?	**3. Students' (computing and non-computing major groups) view of ethics in computing will change after exposure to the course pedagogy.**	**These questions are found on the Post Survey only:** How much did the course help you in becoming more aware of ethical issues involving computer technology? Rank the following exercises you felt assisted you in identifying and analyzing ethical issues. (Use 6 as the lowest ranked and 1 as the highest ranked.)

3.4.1 Measurement and Operationalizing the Variables

Independent Variables

The demographic information on both the pre and post evaluation surveys are as follows:

a. Major: University X identifies majors in the computing curriculum as students identified by their programs: Computer Science, Computer and Information Systems. Non-majors are classified as any other major, except computing majors, identified by University X.

b. Gender: The gender variables are identified by the respondent's self-identification.

c. Course: The course name variables are the identified ethics courses offered by the Department of Computer Science at University X as: COSC 418 Ethical and Societal Concerns for Computer Scientists or COSC 480 Professional Ethics for Computer Science majors.

d. Semester and Year: The semester/term variables are designated as: fall or spring when the courses are offered.

e. Student Ranking: Student ranking variables are identified as: freshman, sophomore, junior, and senior.

f. University I.D. or Last five digits of SSN: (Per UMBC IRB this has been changed. The student's identification number is randomly assigned for the purpose of survey identification, not for student identification.)

The majority of demographic data will be used for reporting purposes only in this study. The only independent variable that will be used for comparison analysis is "majors."

Dependent Variables

The following survey questions are associated with the research question #1: *How will students perceive ethics after being exposed to a structured analysis approach (a four-step analysis decision-making tool)?* These survey questions are contained only on the post evaluation and the measurement format is: 1 = *Not at all* to 5 = *Highly*.

- Students are asked to assess their knowledge of ethics after the course.
- Students are asked to assess their perception of how the course increased awareness of ethical issues in computing technology.
- Students are asked to assess their perception of the structured analysis approach used in the class to assist in decision-making processes.
- Students are asked if they would employ the structured analysis approach in their career.

The following survey questions are associated with the research question #2: *How do students' perceptions of the importance of ethics in computing practices change after being exposed to a computer ethics course?*

On the pre and post evaluation surveys, several dependent variables are measured using a five-point Likert scale. For example:

- Students are asked to assess their knowledge of ethics before the course. The measurement is: 1 = *Not at all* to 5 = *Highly*.

- Students are asked to choose the statement that best identified their abilities to make an ethical decision involving computer technology after course. The measurement is: 1 = *I cannot assess my abilities and knowledge in making ethical decisions involving computer technology* to 5 = *I feel highly capable and knowledgeable to make ethical decisions involving computer technology*.
- Students are asked to assess their perceptions of how relevant the ethics courses are in the computer curriculum. The measurement is: 1 = *Should not be a topic area for Computer Science/Information Science majors* to 5 = *Is a highly important topic area for Computer Science/Information Science majors*.

On the pre and post evaluation surveys, several dependent variables are measured using scenario questions for students to respond and complete. For example:

- Students are asked to read a scenario and imagine they were the person in the scenario who is considering taking the issue to the department head's boss. As they consider their options, a variety of reasons might occur to them that support both going to the department heads' boss and not going to the department heads' boss. Students had the following statements to choose from to indicate their reasoning that influenced their final decisions:
    1. No impact on my final decision.
    2. Slight impact on my final decision.
    3. Strong impact on my final decision.
    4. Very strong impact on my final decision.

- Students are asked to distribute $1,000,000 given to them by National Science Foundation's new division: Better Computer Science. They are to distribute the $1 million among ten categories. Students' decisions are based on their judgment of the relative importance of these categories.
- Students are asked to rank a list of computing courses in respect to course content.

The following survey questions are associated with the research question #3:

How do students perceive the ethics course pedagogy after taking the course?

The following survey questions are found on either the pre or post evaluation or on both the pre and post evaluations and contained different measurement formats. For example:

- Students rank a list of ten computing courses in respect to course content. Students are to rank them in accordance to their opinion of importance in a computer science curriculum, which 1 = the most important and 10 = the least important.
- Students are to choose one topic, out of five topics, that contains the greatest ethical dilemmas for the computer professional.
- Students indicate their reason for taking the ethics course. The students have eight options from which to choose.
- Students are asked to choose which class exercise assisted them the most or least in identifying and analyzing ethical issues. The students are to rank class exercises, using 6 = *Lowest* to 1 = *Highest*.

- Students are asked to choose the one class activity that they enjoyed the most. The students are to make a choice between five options.

Note: All statistical procedures that will be needed to analyze data for all above survey questions will be addressed under section 3.6.

3.4.2 Survey Pilot Testing:

The pre and post evaluation surveys were reviewed by a panel of four professors--two professors from the Department of Information and Computer Sciences at University X, as well as two professors from the Language, Literacy and Culture Program at University Y for validity. The instruments were revised and modified based on comments received from the professors. The surveys were distributed to and answered by a group of 20 students at University X during summer 2005 for reliability. This group did not participate in the actual pre and post evaluation study. The collected data from the pilot test group was entered into the computer for reliability test. The CronBach Alpha Correlation Coefficient was run with the pilot test data. The coefficient rating ranges from a -1 for maximum negative reliability to a +1 for maximum positive reliability and is used to measure internal consistencies among the items of the instrument. As a result, the CronBach Alpha was found to be +. 71; for both the pre and post evaluation surveys.

The pre and post evaluation surveys contained questions used in a previous study from the NSF DOLCE Project. The Computer Ethics Survey was developed by efforts from project investigators and an assessment specialist. The investigators and specialist have combined background and experience in quantitative research methodology, computer science education, and ethics. The DOLCE Computer Ethics

Attitude survey was used and administered in workshops for faculty and students. "The Computer Ethics Attitudes Survey was administered to participating faculty before and after the summer workshop. This same survey was administered to the students of the participating faculty before and after taking a given computer ethics course or module" (Moskal, King, Miller & Camp, 2003, p5).

3.5 Data Collection Process

The pre-evaluation survey will be distributed to students enrolled in the instructor's sections of ethics courses (COSC 418 & COSC 480). During the course of the fall and spring semesters, the researcher will collect between 50 to 100 pre and post evaluation surveys. The pre-evaluation survey will be given during the first week of classes each semester when the courses are offered (during the fall and spring semesters). Students will be given a letter explaining the purpose of the research (See Appendix E). In addition, the students who participate in the study will be asked to sign a consent form (See Appendix E). The information in the pre and post evaluation surveys is confidential, which means that no identifiable information about the student is divulged in this or any other publication. After distribution of the pre-evaluation survey, ethical instruction starts.

The post-evaluation survey is distributed to students after completion of the ethical instruction. After collection of the post-evaluation survey, the students' randomly assigned numbers will be matched to the completed pre-evaluation survey for data input.

3.6 Statistical Procedures/Methodology

The collected data, both pre and post, will be entered numerically into the computer system for analyses and syntheses. The latest software version of the Statistical Package for the Social Sciences (SPSS) will be employed to analyze and synthesize the data. Descriptive statistics, including frequency of numbers, percentages, means, and standard deviations, will be used to report the analysis of demographic data and survey questions on either the pre or post evaluations, not both. Inferential statistics will be used for data analysis on survey questions that are included on both the pre and post evaluations and for comparing majors and non-majors participants. Specifically, the following inferential statistics methods will be applied on questions contained in both the pre and post evaluations:

1. Dependent (paired) t-test procedures will be applied to survey questions that have Likert-scale measurement formats.
2. Non-parametric dependent test procedures will be applied to survey questions that have rank-order measurement formats.
3. Chi-square test procedures will be applied to survey questions that have ordinal (categorical) measurement formats.
4. Independent t-test procedures will be applied to survey questions that compare computing majors versus non-computing majors, whether questions are on the pre, post, or pre and post evaluations. All of these survey questions used in this analysis is formatted in Likert-scale measurements.

For the purpose of comparing students' perceptions between computing and non-computer major groups, the difference between pre and post evaluation responses was

calculated. The calculated difference was applied to compare perceptions of computer and non-computer majors' responses.

The .05 level of significance will be chosen as criterion for testing the hypotheses of this study.

On the following page, Table 5 lists the research questions, the associated hypotheses, related survey questions, and the statistical tests to be performed on each question.

Table 5. *Research Questions, Hypotheses, Survey Questions, & Statistical Tests*

Research Questions	**Research Hypotheses**	**Survey Questions** (See Appendix B)	**Statistical Tests**
1. How will students perceive ethics after being exposed to a structured analysis approach (a four-step analysis decision-making tool)?	**1a. Students' (computing and non-computing major groups) perceptions of ethics will increase after using the four-step analysis decision-making tool.** **1b. Perception of decision-making abilities will be different between computing majors and non-computing majors after using the four-step analysis decision-making tool.**	**This question is found on the Post Survey only:** Did the structured analysis approach used in this course assist you in formulating your ethical decision? **These questions are found on both the Pre and Post Surveys:** Rate their awareness of ethical issues; Choose the area of importance in regards to ethical issues; Identify their ability to make an ethical decision; Choose whether or not ethics is relevant in a computing major	Number, percentage, mean and standard deviation Independent t-test
2. How do students' perceptions of the importance of ethics in computing practices change after being exposed to a computer ethics course?	**2. Students' (computer and non-computer major groups) perceptions of the importance of ethics in computing practices will change after taking the ethics course.**	**These questions are found on both the Pre and Post Surveys:** Before/After taking this course, I would rate my awareness of ethics in computer technology as: Before/After taking this course, identify the importance of ethics in computing Which area of computer ethics do you feel holds the greatest amount of ethical dilemmas for the computer professional? Rank a list of courses from 1 to 10 **Note: This is where the two scenario exercise and distribution of monies exercise would fit in.**	Dependent (paired) t-test Chi square test Non-parametric
3. How do students perceive the ethics course pedagogy after taking the course?	**3. Students' (computer and non-computer major groups) view of ethics in computing will change after exposure to the course pedagogy.**	**These questions are found on the Post Survey only:** How much did the course help you in becoming more aware of ethical issues involving computer technology? Rank the following exercises you felt assisted you in identifying and analyzing ethical issues. (Use 6 as the lowest ranked and 1 as the highest ranked.)	Number, percentage, mean and standard deviation

3.7 Summary

This research is designed to study the perceptions of students who are enrolled in a computer ethics course. The population of the study includes students from the researchers' two computer ethics courses (identified as COSC 418 and COSC 480). The instruments used are adopted from a pre-existing survey sponsored by the National Science Foundation with modifications and additions for this research. For this study, the instruments are defined as pre and post evaluation surveys. These instruments were distributed during the ethics course. The pre evaluation survey was distributed at the beginning of course instruction. The post evaluation was distributed towards the end of course instruction. Both the pre and post evaluation surveys contain the same questions; however, there are questions that are only specific to the pre evaluation survey and questions that are only specific to the post evaluation survey.

The collected data from the surveys is analyzed using the Statistical Package for Social Sciences (SPSS). Analyses include descriptive and inferential tests and procedures. Chapter four presents the analysis of the data and findings.

Chapter 4: Data Analysis

Overview

- Introduction
- Demographic characteristics of student participants
- Analyses of the Data (Testing the hypotheses)
- Summary

4.1 Introduction

Literature and computing accreditation organizations are indicating that computer ethics is a crucial subject matter in the computing curricula. Recent literature and curriculum development have frequently discussed and researched the pedagogical aspects of computer ethics in computing curricula. While these endeavors are very important and necessary, it is also essential to examine how students perceive the topic of ethics within a computing curriculum. Students' responses to the affects of an ethics course can provide an indication into how ethics is perceived in computing.

In this research, the topic of ethics is framed within a context of students' responses on their perceptions to questions on pre and post evaluation surveys. The pre and post evaluation survey questionnaires were distributed to measure student's responses to their perception of the ethics courses (COSC 418 and COSC 480). The surveys were distributed during the Spring 2008 semester. The pre evaluation survey was distributed to students before course instruction. The post evaluation survey was distributed to students towards the end of course instruction. The data analysis

reported in this research represents 78 surveys collected from a total of three sections of COSC 418 and one section of COSC 480. The collected data was entered numerically into the Statistical Package for the Social Sciences (SPSS) for analysis (Cronk, 2002). Both statistical procedures, descriptive and inferential, were used for data analyses. Descriptive statistics include frequency of numbers and percentages, standard deviation, and mean. Inferential statistics include paired-sample t-tests, independent t-tests, chi-square, and non-parametric testing (Wilcoxon). This chapter presents the analyses of data and the findings. This phase of the research examines relationships between students understanding ethics regarding computing technologies with the pedagogical methods used in the computer ethics course. In addition, the chapter presents demographic characteristics of student participants, analyses of the data for testing the hypotheses formulated for this study, and summary.

4.2 Demographic characteristics of student participants

The following section presents demographic information on student participants in this study.

Gender: The majority of participants were male 59 (75.6%) and the smaller group of participants was female 19 (24.4%).

Citizenship: The larger group of participants identified themselves as domestic (U.S. citizens) 74 (94.9%) and the smaller group identified themselves as international (non-U.S. citizens) 4 (5.1%).

Ethnicity: The larger group of participants were identified as Caucasian 60 (76.9%), with the smaller groups identified as African-American and Asian each at 8 (10.3%), and Hispanic/Latino and Other each at 1 (1.3%).

Course: The three-credit course, COSC 418, had the larger group of student participants 52 (66.7%) with the one-credit course, COSC 480, representing a smaller number of student participants 26 (33.3%).

Major: Computing and Math majors represented the larger group 46 (59%) followed by Business majors 16 (20.5%), Humanities/Liberal Arts majors 9 (11.5%), and Social Sciences majors 7 (9%).

Rank: Seniors represented the majority of student participants 42 (53.8%) followed by Juniors 28 (35.9%) and Sophomores 8 (10.3%). Table 6 presents the results:

Table 6
Demographic Characteristics of Student Participants

Demographic Characteristics	Categories	N	%
Gender	Male	59	75.6
	Female	19	24.4
Citizenship	International	4	5.1
	Domestic	74	94.9
Ethnicity	Caucasian	60	76.9
	African American/Black	8	10.3
	Hispanic/Latino	1	1.3
	Asian	8	10.3
	Other	1	1.3
Course	COSC 418	52	66.7
	COSC 480	26	33.3
Major	Computing/Math	46	59
	Humanities/Liberal Arts	9	11.5
	Social Sciences	7	9
	Business	16	20.5
Rank	Sophomore	8	10.3
	Junior	28	35.9
	Senior	42	53.8

Students were asked why they enrolled in the ethics course on the pre evaluation survey. The majority of students (55.1%) self-reported that the ethics course was part of their computing major requirement; (45%) of student responses reported that they enrolled for various reasons (23% out of the 45% reported that they enrolled to fulfill a general education requirement). Table 7 presents the results:

Table 7
Reason for taking the ethics course: Pre Evaluation

Categories	N	%
Requirement for major: computing	43	55.1
Requirement for major: business	9	11.5
To fulfill a General Education Requirement	18	23.1
Course description was interesting	1	1.3
Recommended by an Advisor	3	3.8
Addition of course would be advantageous	1	1.3
Interested in the topic of ethics	3	3.8

4.3 Analyses of the Data (Testing the hypotheses)

This section presents analyses of the collected data and testing of the formulated hypotheses. In order to test all the formulated hypotheses to compare responses from the pre and post evaluations surveys, combinations of the following statistical analyses were performed: frequencies, paired-sampled t-tests, chi-square, non-parametric tests, and independent t-tests. These tests were conducted to detect main effects of the independent variables on students' perceptions, as well as comparing computing and non-computing groups.

4.3.1 Hypothesis Testing

Hypothesis 1a: Students' (computing and non-computing majors) perceptions of ethics will increase after using the four-step analysis decision-making tool.

Frequencies, means, and standard deviations were performed to test the research hypothesis.

$H1_{a1}$: The statistical analysis using frequency of numbers, the mean, and standard deviation showed the majority of the student participants self-reported that they would somewhat 29 (37.2%) and very much 25 (32.1%) apply the four-step analysis approach in decision-making after taking the ethics course. This makes a total of 54 (69.3%) students. Therefore, the results support the hypothesis.

Table 8 and figure 3 present the results of overall students' responses to the question whether they would use this approach after the course:

Table 8
Overall Students' Responses Regarding Use of Analysis Approach after Course Post Evaluation

Categories	N	%	Mean	Std. Deviation
Not at all	6	7.7	3.2	1.1
A little	10	12.8		
Somewhat	29	37.2		
Very much	25	32.1		
Highly	8	10.3		

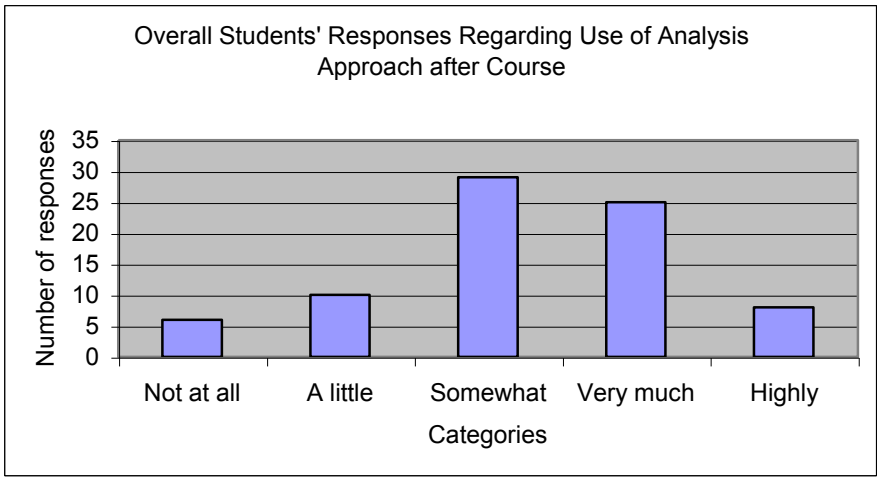

Figure 3

$H1_{a2}$: The statistical result, using independent t-test, showed no significant difference between computing majors and non-computing major groups' self-reports regarding whether they would use the analysis approach after the ethics course. Therefore, the results support the hypothesis. Table 9 below presents the results:

Table 9
Computing Major and Non-Computing Major Groups' Responses Regarding Use of the Analysis Approach after Course: Post Evaluation

Groups	N	Mean	Std. Deviation	t	df	p
Computing Majors	46	3.2	1.0	-.91	76	.36
Non-Computing Majors	32	3.4	1.1			

$H1_{a3}$: The statistical analysis using frequency of number, the mean, and standard deviation showed the majority of the student participants self-reported they felt somewhat 30 (38.5%) and very much 29 (37.2%) that the four-step analysis approach was helpful in the decision-making process after taking the ethics course, which makes a total of 59 (75.7%) students. The findings supported the stated hypothesis.

Table 10 and figure 4 present the results of overall students' responses to the question whether they felt if this approach assisted them in a decision-making process:

Table 10
Overall Students' Responses Regarding if Analysis Approach Helpful in Decision-Making: Post Evaluation

Categories	N	%	Mean	Std. Deviation
Not at all	3	3.8	3.5	.95
A little	5	6.4		
Somewhat	30	38.5		
Very much	29	37.2		
Highly	11	14.1		

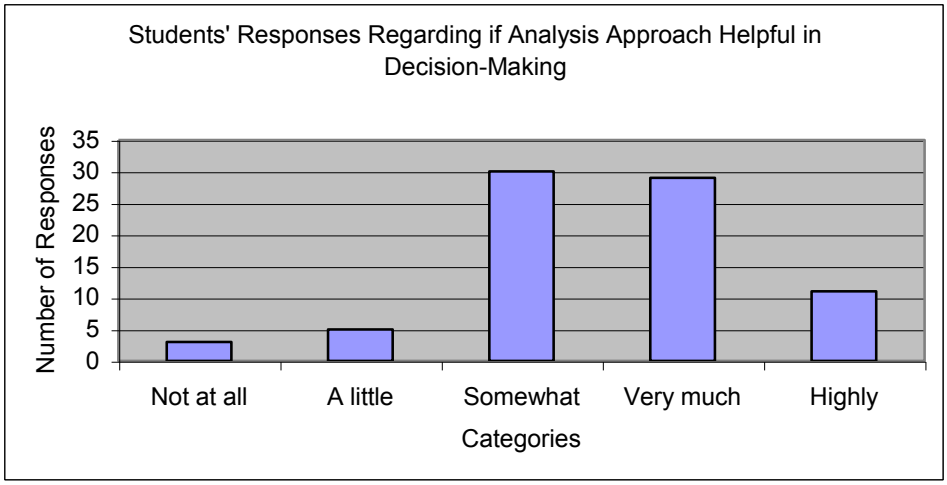

Figure 4

$H1_{a4}$: The statistical results using independent t-test showed no significant difference between computing majors and non-computing majors' self-reports regarding whether the analysis approach assisted them in a decision-making process. Table 11 below presents the results.

Table 11
Computing Major and Non-Computing Major Groups' Responses Regarding If Analysis Approach Helpful in Decision-Making: Post Evaluation

Groups	N	Mean	Std. Deviation	t	df	p
Computing Majors	46	3.4	1.0	-1.9	76	.07
Non-Computing Majors	32	3.8	.84			

Hypothesis 1b: Perception of decision-making abilities will be different between computing majors and non-computing majors after using the four-step analysis decision-making tool.

Paired-sample t-test was performed to test the research hypothesis.

$H1_{b1}$: Table 12 presents the statistical result, using paired-sample t-test, of overall students' self-reports as to whether there was a difference in decision-making abilities before and after taking the ethics course. The statistical results showed a significant difference in decision-making abilities of students before and after taking the ethics course: $Mean_{pre} = 3.4$, $Mean_{post} = 3.9$, $p = .00 < .05$. The post evaluation results showed higher mean in decision-making abilities for all students. Therefore, the result supports the hypothesis.

Table 12
Comparison of Pre Evaluation and Post Evaluation Responses of Students Regarding their Decision-Making Abilities

Groups	N	Mean	Std. Deviation	t	df	p
Pre Post	78 78	3.44 3.97	.85 .77	-4.7	77	.00*

*Denotes significance at .05 level

$H1_{b2}$: The statistical result, using independent t-test, showed no significant difference between computing and non-computing major groups' self-reports as to whether there is a difference in decision-making abilities before and after taking the ethics course. Therefore, the result does not support the hypothesis. Table 13 presents the results:

Table 13
Comparison of Computing Major and Non-Computing Major Groups' Responses Regarding their Decision-Making Abilities

Groups	N	Mean	Std. Deviation	t	df	p
Computing Majors	46	.41	1.1	-1.3	76	.19
Non-Computing Majors	32	.72	.81			

Hypothesis 2: Students' (computing and non-computer majors) perceptions of the importance of ethics in computing practices will change after taking the ethics courses. Paired-sample t-tests and non-parametric statistical tests were performed to test the research hypothesis.

$H2_{a1}$: Table 14 presents the results, using paired sample t-test, of overall students' responses of whether there is or is not a change in their awareness of ethics in computing before and after taking the course. The statistical result showed a significant difference in the pre and post results on students' self-reports: $Mean_{pre}$ = 2.9, $Mean_{post}$ = 3.9, p = .000 < .05. The post evaluation results showed higher mean in course awareness. Therefore, the results support the hypothesis.

Table 14
Comparison of Pre-Evaluation and Post Evaluation Responses of Students Regarding Course Awareness

Groups	N	Mean	Std. Deviation	t	df	p
Pre	78	2.9	.94	-3.1	76	.00*
Post	78	3.9	.79			

*Denotes significance at .05 level

$H2_{a2}$: The statistical result, using independent t-test, showed a significant difference between computing and non-computing major groups' self-reports regarding whether the course increased their awareness of ethics. The difference pre to post for computing major and non-computing major groups is $Mean_{pre}$ = .67, $Mean_{post}$ = 1.44, p = .003 < .05. The post results, for both groups, showed higher mean in course awareness. Therefore, the result supports the hypothesis. Table 15 presents the result:

Table 15
Comparison of Computing Major and Non-Computing Major Groups' Responses Regarding Course Awareness

Groups	N	Mean	Std. Deviation	t	df	p
Computing Majors	46	.67	1.1	-3.1	76	.003*
Non-Computing Majors	32	1.4	.98			

*Denotes significance at .05 level

$H2_{a3}$: Table 16 presents the results of overall students' responses to the scenario exercise, in which students were asked to read a scenario and imagine they were the person in the scenario. As they consider their options, a variety of reasons might occur to them that support both going to the department head's boss and not going to the department head's boss. The results using paired-sample t-test showed a significant difference between the pre and post responses for only two items:

A) Base decision on promotion opportunity: $Mean_{pre} = 2.1$, $Mean_{post} = 2.4$, $p = .02 < .05$. The post results showed higher mean on basing decision on promotion opportunity. Therefore, this result supports the hypothesis.

B) Base decision on the code of ethics for computer scientists: $Mean_{pre} = 2.2$, $Mean_{post} = 2.5$, $p = .05 \leq .05$. The post results showed higher mean on basing decision on code of ethics. Therefore, this result supports the hypothesis.

C) While not statistically significant at the $p = .05$ level, two other items approached statistical significance:

1. Rely on the experience of others: $Mean_{pre} = 2.2$, $Mean_{post} = 2.0$, $p = .07 > .05$

2. Focus concern on the people who will use the product: $Mean_{pre} = 3.7$, $Mean_{post} = 3.4$, $p = .07 > .05$

Table 16

Comparison of Pre Evaluation and Post Evaluation Responses of Students Regarding the Scenario Exercises

Statement Items	Groups	N	Mean	Std. Deviation	t	df	p
The software will improve anti-lock brakes	Pre Post	78 78	3.0 3.1	1.0 .90	-.73	77	.46
Don't want to lose job for wrong decision	Pre Post	78 78	2.6 2.5	.99 .98	.72	77	.48
Organization has an obligation	Pre Post	78 78	2.8 2.9	1.1 1.1	-.48	77	.63
Rely on the experience of others	Pre Post	78 78	2.2 2.0	.91 .88	1.8	77	.07
Don't want to be blamed for any trouble from decision	Pre Post	78 78	2.2 2.3	1.1 1.1	-.73	77	.47
Base decision on promotion opportunity	Pre Post	78 78	2.1 2.4	1.0 1.0	-2.3	77	.02*
Base decision on what is best for the organization	Pre Post	78 78	2.5 2.5	.96 .86	-.77	77	.45
Have a responsibility to protect the public	Pre Post	78 78	3.2 3.3	.88 1.2	-.80	77	.48
Base decision on result of performance evaluation	Pre Post	78 78	2.2 2.5	.90 1.1	-1.6	77	.11
Base decision on the code of ethics for computer scientists	Pre Post	78 78	2.2 2.5	.95 .95	-2.0	77	.05*
Follow company's rules	Pre Post	78 78	2.1 2.2	.83 .83	-1.0	77	.31
Focus concern on the people who will use the product	Pre Post	78 78	3.7 3.4	.75 .91	1.9	77	.07

*Denotes significance at .05 level

$H2_{a4}$: Table 17 presents the statistical results, using independent t-test; comparing means of computing majors' and non-computing majors' pre and post responses to the scenario exercises. The statistical results showed significant

difference between computing majors and non-computing majors' self-reports only in one item in the scenario exercise: Focus concern on the people who will use the product. Computing majors$_{mean}$ = -.02, Non-computing majors$_{mean=}$ -.50, p = .04 < .05. The non-computer major group results showed a higher mean in pre to post in this subject category.

Table 17
Comparison of Computing Major and Non-Computing Major Groups' Responses Regarding the Scenario Exercises

Statement Items	Groups	N	Mean	Std. Deviation	t	p
The software will improve anti-lock brakes	Computing Majors Non- Majors	46 32	.17 .00	1.1 1.4	.61	.54
Don't want to lose job for wrong decision	Computing Majors Non- Majors	46 32	.07 -.31	1.0 1.2	1.5	.14
Organization has an obligation	Computing Majors Non- Majors	46 32	.11 .03	1.6 1.2	.24	.82
Rely on the experience of others	Computing Majors Non- Majors	46 32	-.28 -.16	1.0 1.2	-.50	.62
Don't want to be blamed for any trouble from decision	Computing Majors Non- Majors	46 32	-.04 .31	1.1 1.4	-1.2	.22
Base decision on promotion opportunity	Computing Majors Non- Majors	46 32	.20 .44	1.0 1.2	-.94	.35
Base decision on what is best for the organization	Computing Majors Non- Majors	46 32	.11 .06	.95 1.2	.19	.85
Have a responsibility to protect the public	Computing Majors Non- Majors	46 32	.28 -.09	1.3 1.5	1.2	.25
Base decision on result of performance evaluation	Computing Majors Non- Majors	46 32	.17 .25	.90 1.4	-.30	.77
Base decision on the code of ethics for computer scientists	Computing Majors Non- Majors	46 32	.24 .31	1.0 1.4	-.27	.79
Follow company's rules	Computing Majors Non- Majors	46 32	.02 .25	.93 1.1	-1.0	.33
Focus concern on the people who will use the product	Computing Majors Non- Majors	46 32	-.02 -.05	.91 1.1	2.1	.04*

*Denotes significance at .05 level

$H2_{a5}$: Table 18 below shows overall students' responses to the question which asked them to distribute $1,000,000 for the National Science Foundation's new division: Better Computer Science. They are to distribute the $1 million among ten categories. Students' decisions are based on their judgment of the relative importance of these categories. The results using paired-sample t-test showed a significant difference between the pre and post evaluation responses for only one item: Ethical and Social Issues in Information Technology. The result shows the $Mean_{pre}$ = $86,346, $Mean_{post}$ = $112,218, $p = .01 < .05$. The post evaluation results showed higher mean in awarding money in this category. Therefore, this result supports the hypothesis.

Table 18: *Comparison of Pre Evaluation and Post Evaluation Students' Responses Regarding Monetary Categorization of Computing Areas*

Subject Categories	Groups	Mean Dollars ($)	Std. Deviation	t	df	p
Artificial Intelligence	Pre Post	108,359 108,064	79,345 115,959	.02	77	.98
Biometrics	Pre Post	128,821 106,449	174,887 120,796	.94	77	.35
Commercial Off-The-Shelf Software (COTS)	Pre Post	71,679 80,782	43,528 43,918	-1.2	77	.22
Database Management	Pre Post	104,308 108,885	594,432 73,855	-.45	77	.65
Ethical and Social Issues in Information Technology	Pre Post	86,346 112,218	62,036 93,721	-2.7	77	.01*
Formal Methods in Computer Science	Pre Post	202,436 80,064	1,124,627 39,686	.96	77	.34
Image Processing	Pre Post	79,423 72,103	66,450 47,780	.82	77	.42
Networking	Pre Post	123,974 114,295	85,324 71,703	.88	77	.38
Programming Languages	Pre Post	104,346 107,103	85,368 66,320	-.25	77	.80
Robotics	Pre Post	95,077 88,564	64,111 46,871	.77	77	.44

*Denotes significance at .05 level

$H2_{a6}$: Table 19 presents the results of computing majors' and non-computing majors' responses to the monetary categorization exercise. The statistical results, using independent t-test, showed significant difference between the computing and non-computing majors' responses in only one subject category: Ethical and Social Issues in Information Technology: Computing $majors_{mean}$ = -6,804, Non-computing $majors_{mean=}$ 53,281, p = .03 < .05. The computing major group showed higher negative mean (post lower than pre); however, the non-computer major group results showed higher positive monetary mean (pre to post) in this subject category.

Table 19: *Comparison of Computing Major and Non-Computing Major Groups' Responses Regarding Monetary Categorization of Computing Areas*

Subject Categories	Groups	N	Mean	Std. Deviation	t	p
Artificial Intelligence	Computing Majors Non-computing Majors	46 32	-15,587 21,687	73,244 176,679	-1.3	.20
Biometrics	Computing Majors Non-computing Majors	46 32	-7,065 -44,375	147,944 279,309	.77	.45
Commercial Off-The-Shelf Software (COTS)	Computing Majors Non-computing Majors	46 32	3,326 17,406	64,062 65,596	-.95	.35
Database Management	Computing Majors Non-computing Majors	46 32	7,283 688	109,376 50,649	.32	.72
Ethical and Social Issues in Information Technology	Computing Majors Non-computing Majors	46 32	6,804 53,281	52,251 109,166	-2.5	.03*
Formal Methods in Computer Science	Computing Majors Non-computing Majors	46 32	213,804 9,063	1,460,845 53,392	-.86	.39
Image Processing	Computing Majors Non-computing Majors	46 32	-10,913 -2,156	47,217 110,460	-.48	.65
Networking	Computing Majors Non-computing Majors	46 32	435 -24,219	103,295 88,008	1.1	.28
Programming Languages	Computing Majors Non-computing Majors	46 32	-4,891 13,750	117,045 53,377	-.84	.40
Robotics	Computing Majors Non-computing Majors	46 32	-11,457 594	81,331 64,087	-.70	.49

*Denotes significance at .05 level

$H2_{a7}$: Table 20 presents the results of overall students' responses to the question, which asked them to rank a list of issues covered in the ethics course. Students' decisions were based on their judgment of the relative importance of these issues in conjunction with the topic of ethics. The statistical result using chi square showed no significant difference between the pre and post evaluations' responses. Therefore, the results do not support the hypothesis.

Table 20

Comparison of Pre Evaluation and Post Evaluation Responses of Students Regarding Importance of Ethical Issues

Rank importance of ethical issues (Pre)		Rank importance of ethical issues (Post)						Chi-square Test	
		Privacy	Intellectual Property	Computer Crimes	Security	Social Issues	Total	Chi-Square	p
Privacy	N	13	8	6	5	0	32	15.9	.456
	%	40.6	25.0	18.8	15.6	0	100		
Intellectual Property	N	2	4	2	2	0	10		
	%	20.0	40.0	20.0	20.0	0	100		
Computer Crimes	N	3	1	5	2	1	12		
	%	25.0	8.3	41.7	16.7	8.3			
Security	N	9	1	5	4	1	20		
	%	45.0	5.0	25.0	20.0	5.0	100		
Social Issues	N	3	1	0	0	0	4		
	%	75.0	25.0	0	0	0	100		
Total	N	30	15	18	13	2	78		
	%	38.5	19.2	23.1	16.7	2.6	100		

$H2_{a8}$: Table 21 presents the results of overall students' responses to the question that asked them to rank a list of computing courses in respect to course content. Students' decisions were based on their judgment of the relative importance of these categories where 1 = the most important and 10 = the least important. The results, using non-parametric statistical tests (Wilcoxon), showed no significant difference between the pre and post responses. Therefore, the results do not support the hypothesis.

Table 21
Comparison of Pre Evaluation and Post Evaluation Responses of Students Regarding Ranking Computing-Related Topics

Categories	Groups	N	Mean	Std. Deviation	p
Artificial Intelligence	Pre Post	78 78	6.1 6.0	2.7 2.8	.84
Data Structures	Pre Post	78 78	4.1 4.4	2.5 2.4	.51
Database	Pre Post	78 78	4.7 4.3	2.2 2.3	.21
Distributed Computing	Pre Post	78 78	6.5 6.3	2.4 2.2	.36
Ethical Issues in Computing	Pre Post	78 78	5.2 4.7	3.0 3.2	.21
Finite Automata	Pre Post	78 78	7.2 7.6	2.7 2.2	.28
Graphics	Pre Post	78 78	7.3 7.2	2.8 2.6	.66
Operating Systems	Pre Post	78 78	4.5 4.9	2.8 2.6	.12
Software Engineering	Pre Post	78 78	4.2 4.6	2.8 3.1	.31
Testing and Reliability	Pre Post	78 78	5.2 5.0	2.6 2.8	.95

$H2_{a9}$: Table 22 presents the results of computing majors' and non-computing majors' responses ranking a list of computing courses in respect to course content exercise. The statistical results, using independent t-test, showed significant difference between the computing and non-computing majors' self-reports responses in only one category, Ethical Issues in Computing (Computing $majors_{mean}$ = 3.9, Non-

computing majors$_{mean=}$ -1.8, p = .00 < .05). The computer major group's pre to post results ranked this category higher in this subject category (higher mean).

Table 22
Comparison of Computing Major and Non-Computing Major Groups' Responses Regarding Ranking Computing-Related Topics

Categories	Groups	N	Mean	Std. Deviation	t	p
Artificial Intelligence	Computing Majors Non-computing Majors	46 32	-.08 -.16	3.4 3.5	.09	.93
Data Structures	Computing Majors Non-computing Majors	46 32	.22 .41	3.3 3.0	-.26	.80
Database	Computing Majors Non-computing Majors	46 32	-.80 .16	2.9 3.3	-1.3	.18
Distributed Computing	Computing Majors Non-computing Majors	46 32	-.08 -.41	3.9 2.8	.40	.69
Ethical Issues in Computing	Computing Majors Non-computing Majors	46 32	.39 -1.8	3.2 3.4	3.0	.00*
Finite Automata	Computing Majors Non-computing Majors	46 32	.57 .22	3.1 3.3	.47	.65
Graphics	Computing Majors Non-computing Majors	46 32	.04 -.40	3.4 3.7	.56	.58
Operating Systems	Computing Majors Non-computing Majors	46 32	.04 1.1	2.6 3.8	-1.4	.17
Software Engineering	Computing Majors Non-computing Majors	46 32	-.20 1.1	3.9 4.1	-1.4	.16
Testing and Reliability	Computing Majors Non-computing Majors	46 32	-.26 .00	3.6 3.7	-.31	.76

*Denotes significance at .05 level

$H2_{a10}$: Table 23 presents the statistical result, using paired sample t-test, of overall students' responses of whether there is or is not a change between the importance of ethics in computing before and after taking the ethics course. The statistical result showed no significant difference in the pre and post results on

students' self-reporting on this issue. Therefore, the result does not support the hypothesis.

Table 23
Comparison of Pre Evaluation and Post Evaluation Responses of Students Regarding the Importance of Ethics in Computing

Groups	N	Mean	Std. Deviation	t	df	p
Pre Post	78 78	3.9 4.1	.91 .86	-1.9	77	.06

The above table shows the analysis for the following five categories:

1. Should not be a topic area for computer science/information systems majors.
2. Is not a relevant topic area for computer science/information systems majors.
3. Is somewhat a relevant topic area for computer science/information systems majors.
4. Is a very important topic area for computer science/information systems majors.
5. Is a highly important topic area for computer science/information systems majors.

The researcher wanted to clarify any results that could have affected the outcome of the analysis based on the design of the questions. By combining categories 1 and 2 as one item, the result showed no significant change.

$H2_{a11}$: The statistical result using independent t-test showed no significant difference between computing major and non-computing major groups' pre and post self-reports results regarding the importance of ethics in computing. Table 24 presents the results:

Table 24
Comparison of Computing Major and Non-Computing Major Groups' Responses Regarding the Importance of Ethics in Computing

Groups	N	Mean	Std. Deviation	t	df	p
Computing Majors	46	.15	.94	-.60	76	.55
Non-Computing Majors	32	.28	.92			

Hypothesis 3: Students' (computing and non-computing majors) view of ethics in computing will change after exposure to the course pedagogy.

Frequencies of numbers and percentages were performed to test the research hypothesis.

$H3_{a1}$: Table 25 and figure 5 below show the overall students' responses to the question, which they were asked to select one course activity that assisted them in becoming more aware of ethics.

The descriptive analysis of the results and findings showed the majority of the student participants self-reported discussions 57 (73.1%) as the activity in which assisted them in increasing their ethical awareness. The findings supported the stated hypothesis. Table 25 and figure 5 present the results:

Table 25
Overall Students' Responses Regarding the Class Activity Most Enjoyed: Post Evaluation

Categories	N	%
Discussions	57	73.1
Working in a group	4	5.1
Readings/Articles	10	12.8
Lectures Topics	7	9.0

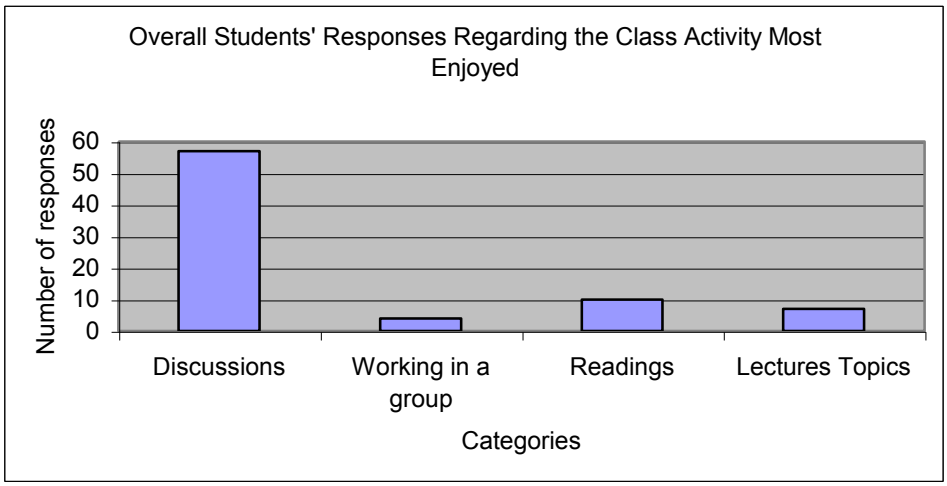

Figure 5

$H3_{a2}$: The statistical result using chi-square showed no significant difference on the post evaluation between computing major and non-computing major groups' self-reports regarding the class activity they enjoyed the most. Table 26 presents the results:

Table 26
Comparison of Computing Major and Non-Computing Major Groups' Responses Regarding Class Activity Enjoyed the Most – Post Evaluation

Categories		Computing Major	Non-Computing Major	Total	Chi-Square	p
Discussion	N %	36 63.2	21 36.8	57 100	7.42	.06
Working in a group	N %	0 0	4 100	4 100		
Reading/Articles	N %	7 70	3 30	10 100		
Lecture topics	N %	3 42.9	4 57.1	7 100		
Total	N %	46 59.0	32 41.0	78 100		

$H3_{a3}$: Table 27 and figure 6 below show the overall students' responses to the question of whether the course pedagogy assisted in increasing their ethical awareness.

The descriptive analysis of the results and findings showed the majority of the student participants self-reported they very much 40 (51.3%) and somewhat 25 (32.1%) believed the course increased their ethical awareness, which makes a total of 65 (83.4%) students. The findings supported the stated hypothesis.

Table 27: *Overall Students' Responses Regarding if the Course Assisted in Increasing Ethical Awareness: Post Evaluation*

Categories	N	%	Mean	Std. Deviation
Not at all	1	1.3	3.7	.77
A little	2	2.6		
Somewhat	25	32.1		
Very much	40	51.3		
Highly	10	12.8		

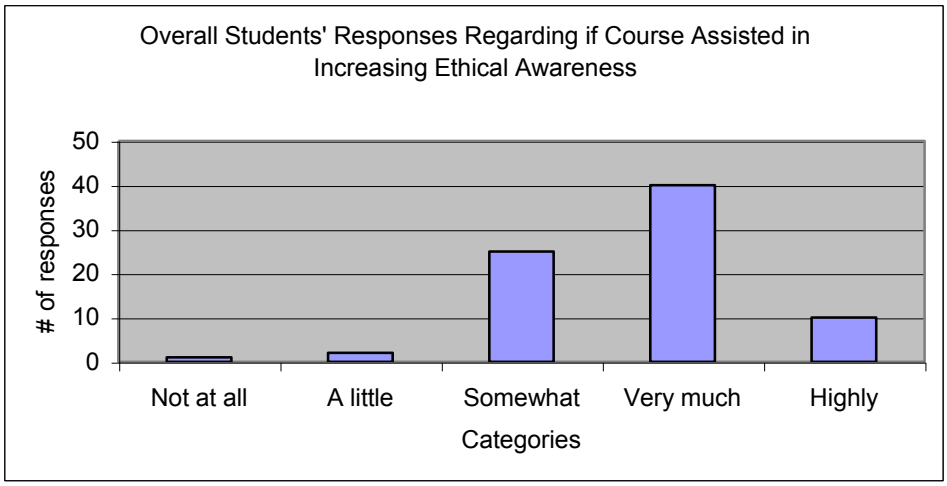

Figure 6

$H3_{a4}$: The statistical result, using independent t-test, showed no significant difference on the post evaluation responses between computing majors and non-computing major groups regarding if the course increased their awareness of ethics in computing. Table 28 presents the results:

Table 28
Comparison of Computing Major and Non-Computing Major Groups' Responses Regarding if Course Increased their Awareness of Ethics in Computing – Post Evaluation

Groups	N	Mean	Std. Deviation	t	df	p
Computing Majors	46	3.8	.86	-1.4	76	.16
Non-Computing Majors	32	4.1	.67			

$H3_{a5:}$ Table 29 shows overall students' responses to the question, which asked them to rank class exercises from (1 = highest to 6 = lowest). Students based their ranking on which class exercise they perceived assisted them in the ethics course.

The descriptive analysis of the results and findings showed the majority of students self-reported the following exercise categories assisted them in the ethics course by assigning high ranking (Ranks 1 and 2): Lectures 35 (44.9%); and, Case Studies 43 (55.1%). The majority of students self-reported the following exercise category did not assist them in the ethics course by assigning low ranking (Ranks 5 and 6): Library Visit 69 (88.5%). Other exercises with somewhat low ranking were: Research Paper 29 (37.2%); and, Reading/Homework 26 (20%). Interestingly, Discussion ranked comparatively with helpful exercises (Ranks 1 and 2) 32 (40%) and with the less helpful exercises (Ranks 5 and 6) 21 (26.9%). The findings supported the stated hypothesis. Table 29 presents the results:

Table 29
Overall Students' Responses regarding if Exercises helped them in the Ethics Course Post Evaluation

Categories		Groups							
		1	2	3	4	5	6	Mean	Std.
Readings/Homework	N %	15 19.2	11 14.1	15 19.2	17 21.8	17 21.8	3 3.8	3.2	1.5
Lectures	N %	9 11.5	26 33.3	22 28.2	14 17.9	7 9.0	0 0	2.8	1.1
Case Studies	N %	24 30.8	19 24.4	15 19.2	14 17.9	5 6.4	1 1.3	2.5	1.3
Research Paper	N %	8 10.3	11 14.1	9 11.5	21 26.9	27 34.6	2 2.6	3.7	1.4
Discussions	N %	21 26.9	11 14.1	13 16.7	12 15.4	20 25.6	1 1.3	3.0	1.6
Library Visit	N %	1 1.3	2 2.6	2 2.6	4 5.1	0 0	69 88.5	5.7	.81

4.4 Summary

The collected data was entered and analyzed in the computer system using the Statistical Package for Social Sciences (SPSS). (Cronk, 2002)

The analyses of the demographic data showed that the majority of respondents were male (76%), American citizens (95%), Caucasian (77%), enrolled in COSC 418, (67%) computing majors (59%), and seniors (54%). The majority of students enrolled in the ethics course self-reported that they were taking the course to fulfill the computing major requirement.

The analyses of the data showed the following:

1. The majority of the students self-reported that they would apply the four-step analysis approach in decision-making after taking the ethics course. On a scale of 1 (not at all) to 5 (highly) the mean score was 3.2 indicating a response slightly above the middle category. There were no differences between computing and non-computing majors in using this decision-making approach.

2. The majority of the students self-reported that the four-step analysis approach was helpful in the decision-making process after completing the ethics course. Here the mean was 3.5, indicating a stronger response. There were no differences between computing and non-computing majors in students' self-reports in this area. Although the difference between the groups approached statistical significance at $p = .07$.

3. A significant difference was found between students' pre and post evaluation responses regarding their decision-making abilities before and after taking the ethics course with post evaluation results showing higher self-reported higher

mean - 3.44 on the pre evaluation survey compared to 3.97 on the post evaluation survey). There were no differences between computing major and non-computing major groups regarding their decision-making abilities before and after taking the course.

4. A significant difference was found between student's pre and post evaluation responses' regarding self-reports of awareness of ethics in computing before and after taking the course with post evaluation results showing higher mean – 2.9 on the pre evaluation survey compared to 3.9 on the post evaluation survey. There was a significant difference between computing major and non-computing major groups regarding if the course increased their awareness of ethics, with the post evaluation results showing (higher mean) for both groups but with the non-computing majors (1.4) showing a greater difference on pre to post than computing majors (.67).

5. In the scenario exercises, there were significant a difference between students' self-reports on the pre and post evaluation responses for the following two items:

a. Base decision on promotion opportunity – Students' post evaluation self-reports results showing higher mean (higher mean – 2.1 on the pre evaluation survey compared to 2.4 on the post evaluation survey) $p = .02$.

b. Base decision on the code of ethics for computer scientists – Students' post evaluation self-reports results showing higher mean (higher mean – 2.2 on the pre evaluation survey compared to 2.5 on the post evaluation survey) $p = .05$.

c. Two other items approached statistical significance at $p = .07$: Rely on the experience of others and Focus concern on the people who will use the product.

6. There was a significant difference between computing major and non-computing major groups for a separate item (Focus concern on the people who will use the product), with the non-computing major group's self-reports showing a higher mean in this subject category. Both groups means decreased slightly but the non-computing group (-.05) had a larger pre to post drop than the computing group (-.02).

7. In the question regarding distributing money among ten categories, there was a significant difference between students' pre and post evaluation responses with students' post evaluation self-reports results showing a higher mean on one item: Ethical and Social Issues in Information Technology. The dollar amount increased from $86,300 to $112,200.

8. There was a significant difference between computing and non-computing majors groups on the pre and post evaluations for one item: Ethical and Social Issues in Information Technology - The non-computer major group's self-reports showing higher positive monetary results in post evaluation responses, (higher positive mean +53,300); whereas, the computing major group's self-reports showing higher negative monetary results**,** in post evaluation responses, (higher negative mean -$6,800) in this subject category. There were larger differences between pre and post results for computing and non-computing major groups for other items but none reach statistical significance. (See Table 19)

9. Students were asked to rank a list of topics/issues covered in the ethics course, according to their importance. There was no significant difference between the pre and post evaluation responses. Although it is interesting to note that one rank

changed more than ranks for other topics even though it is was not statistically significant. (See Table 21)

10. There was a significant difference between computing and non-computing majors groups on the pre and post evaluation responses for the following item: Ethical Issues in Computing. The computing major group ranked this topic higher (higher mean) after taking this course (post mean =. 39 higher than pre mean). Non-computing majors ranked the topic lower after taking the course (post mean = 1.8 less than pre mean). (See Table 22)

11. In the question where students ranked a list of computing courses, according to importance, there was no significant difference between the pre and post evaluation responses.

12. Students were asked to indicate their level of perception regarding the importance of ethics before and after taking the ethics course. Difference between the pre and post evaluation responses approached, although did not attain, statistical significance (pre mean = 3.9, post mean = 4.1, $p = .06$).

13. There was no significant difference between computing and non-computing majors groups between the pre and post evaluation responses regarding the importance of ethics before and after taking the course.

14. The majority of students (73%) self-reported that the discussion activity assisted them in increasing their ethical awareness.

15. There was no significant difference between computing and non-computing majors groups between the pre and post evaluation responses on which class activity assisted them in increasing their ethical awareness.

16. The majority of students self-reported that the ethics course contents assisted them in increasing their ethical awareness. The top two choices (Very much and Highly) garnered 64% of the responses.

17. There was no significant difference found between computing and non-computing majors groups between the pre and post evaluation responses as to whether the ethics course contents assisted them in increasing their ethical awareness.

18. The majority of students ranked the following class exercises highly: case studies and lectures. The students self-reported these exercises as assisting them in becoming more aware of computer ethics.

19. The majority of students (69%) did not find library visits useful in the ethics course.

20. Discussions ranked both high (32% of students) and low (21% of students) as to usefulness in the ethics course.

Chapter five addresses the implications from the data analysis, as well as, recommendations, and suggestions for future research.

Chapter 5: Discussion of Findings and Interpretation

Overview

- Summary of Research
  - Purpose of Study
  - Participants of the Study
  - Instruments of the Study
  - Data Collection and Analyses
- Interpretation of Analyses
- Recommendations (Overall Assessments)
- Suggestions for Future Research
- Conclusion

This chapter presents a summary of the research, conclusions, recommendations and suggestions for further studies.

5.1 Summary of Research

5.1.1 Purpose of Study

The purpose of this research was to examine students' perceptions of ethics as it relates to computing. The study assessed these perceptions from the ethics course and student's experiences with the course content and application. The study was based on information collected in the researcher's previous pilot study. The information from the pilot study indicated additional information could be obtained from students' perceptions of a computer ethics course. This research examined the student's perceptions on the relevance and impact of ethics in a computing course. In addition, this study investigated the differences in perceptions between computing (i.e. computer science, information systems, etc.) students and non-computing students.

Moreover, this study presents a baseline for assessing a four-step analysis decision-making tool used to assist students in ethical decision-making applications regarding computing. The research looked at any differences in the level of knowledge of application of ethics before and after taking the course; and, specifically, if any differences existed in that application between computing students and non-computing students.

5.1.2 Participants of the Study

The population for the study was from the instructor's sections of Ethics and Societal Concerns for Computer Scientists (COSC 418) and Senior Seminar: Professional Ethics (COSC 480) courses during the spring 2008 semester. The analyses of the demographic information of participants showed that the majority of participants were male 59 (75.6%); domestic (U.S. citizens) 74 (94.9%); Caucasian 60 (76.9%); computing majors 46 (59%); seniors 42 (53.8%); and from the COSC 418 class 52 (66.7%).

5.1.3 Instruments of the Study

The instruments used in this study were pre and post evaluation surveys. The surveys are a combination of questions created by the researcher (30%) and questions (70%) from a pre-existing instrument created by the DOLCE (Developing Online/Offline Computer Ethics) Project, sponsored by the National Science Foundation. The main emphasis from the DOLCE Project was on improving computer ethics instruction to computing students. The questions on the surveys, developed by the researcher of this study, are based on course content and required students' responses from their experiences before and after taking the ethics course.

5.1.4 Data Collection and Analyses

The pre-evaluation survey was distributed to students enrolled in the instructor's sections of ethics courses (COSC 418 & COSC 480). During the course of the spring 2008 semester, the researcher collected 78 completed pre and post evaluation surveys. The pre-evaluation survey was distributed during the first week of classes of the semester. The post-evaluation survey was distributed during the last week of classes. The collected data was entered and analyzed using SPSS software. Analyses included descriptive and inferential tests and procedures.

The analyses of data illustrated that:

- Students would apply the four-step analysis approach in decision-making after taking the ethics course.
- Students self-reported that the four-step analysis approach was helpful in their decision-making processes after completing the ethics course.
- Students indicated that their decision-making abilities changed after taking the ethics course, self-reporting a higher decision-making abilities (higher mean) on the post survey.
- Students indicated that their awareness of ethics in computing changed after taking the course, self-reporting a higher awareness (higher mean) on the post survey. There were differences between computing major and non-computing major groups' responses regarding if the course increased their awareness of ethics, self-reporting a higher mean on the post survey.
- In the scenario exercises, students self-reported a higher mean on only two items. There were differences between computing major and non-computing

major groups' for one item, which showed the non-computing major group self-reporting a higher monetary amount (higher mean) in this subject category.

- Students' responses regarding the distribution of money among ten categories self-reported higher monetary amount (higher mean) on one subject category. There were differences between computing and non-computing majors groups' post evaluation responses that showed the non-computer major group self-reported higher positive monetary results, (higher positive mean); whereas, the computing major group self-reported higher negative monetary results, (higher negative mean) in this subject category.
- Students' ranking of a list of topics/issues covered in the ethics course according to importance indicated no differences between the pre and post evaluations responses.
- Students ranking a list of ten computing courses, according to their perception of importance, demonstrated no differences between the pre and post evaluations responses. There were differences between computing and non-computing majors groups' self-reports on one item where the computer major group ranked this item higher (higher mean).
- Students indicated their level of perception regarding the importance of ethics before and after taking the ethics course. There was no significant difference between computing and non-computing majors groups' responses.

- Students self-reported that the discussion activity assisted them in increasing their ethical awareness. There was no significant difference between computing and non-computing majors groups' responses.
- Students self-reported that the ethics course content assisted them in increasing their ethical awareness. There was no significant difference between computing and non-computing majors groups' responses.
- Students self-reported the following class exercises: lectures, discussions, and case studies aided them in becoming more aware of computer ethics.

5.2 Interpretation of Analyses

In this section, the researcher discusses the significant findings of the study, focusing on areas that generated statistically significant results.

The researcher asserted that after taking the ethics course, students will be able to apply the four-step analysis tool in their future ethical decision-making processes involving computing issues.

Based on self-reported data:

1. The majority of students reported that they would apply the four-step analysis approach in decision-making after taking the course. There were no self-reported differences between computing majors and non-computing majors' on whether they would apply the four-step analysis approach in decision-making processes after taking the course.

2. The majority of students self-reported that the four-step analysis approach would be helpful in decision-making processes after the ethics course. There was no

difference in responses between computing majors and non-computing majors on whether the four-step analysis approach would be helpful in decision-making processes after the ethics course.

Therefore, it is concluded that this four-step approach was successful in increasing students' perceptions of ethics. During the several years of teaching the ethics courses, the researcher observed that as students become more familiar with this tool, the more comfortable they are in applying the process in the decision-making processes. For example, students not only applied this process in case study and final paper assignments, but they also applied this process in other assignments that did not specifically require the implementation of the tool. In addition, the researcher noted that students casually incorporated this process in their online and in-class discussions.

The researcher asserted that there will be a difference between computing majors and non-computing majors on whether they would use the four-step approach in decision-making after taking the ethics course. The researcher believed that the difference between computing and non-computing majors in applying the four-step analysis decision-making tool would be based on computing experiences. During the pilot study (see Appendix A), the researcher found that both computing and non-computing majors were exposed to different levels of computing experiences, which might influence how they perceived the four-step analysis decision-making tool. Based on self-reported data:

1) There was a difference on students' pre evaluation and post evaluation self-reported results that showed students decision-making abilities increased after taking the course.

Therefore, it is concluded that course instruction was successful in increasing students' decision-making abilities. This result indicates, to the researcher, that the more students are exposed to class exercises and activities involving this process, the more students believe that their decision-making abilities are enhanced.

2) There was no difference in responses between computing majors and non-computing majors on whether they would use the four-step approach in decision-making after taking the ethics course.

Therefore, it is concluded that the student's major does not affect the application of this approach in decision-making. This result was surprising to the researcher because she believed that the differences in majors and computing experiences would be a major factor in the application of this process.

The researcher asserted that after completing the ethics course, students' perceptions of computing practices will differ from their perceptions before the course. After exposure to the ethics course, the researcher wanted to find out if students' perceived computing practices differently. The researcher did not want to specifically define or address, at this point in the research, the types of differences, only a perceived difference of computing practices after exposure to ethics.

Based on self-reported data:

1) There was a difference in overall students' self-reported responses between pre evaluation and post evaluation results, which showed students' ethical awareness increased after taking the course.

Therefore, it is concluded that course instruction was successful in increasing students' awareness of ethics. In addition, these results indicate, to the researcher that students' perceptions validated the pedagogical methods used in the ethics course.

2) There was a difference between computing majors and non-computing majors' self-reports regarding whether the course increased their awareness of ethics.

Therefore, it is concluded that the increase of ethical awareness is based on the student's major. These results were interesting to the researcher, in that by comparing the computing and non-computing major groups; the non-computing majors believed more than the computing majors that the course increased their awareness of ethics. The researcher assumes that this result could be attributed to the fact that non-computing majors have less exposure to some computing topics, which might indicate the perceived difference in awareness of ethics.

3) There were differences between students' pre evaluation and post evaluation self-reported results on two items (basing decisions on promotion opportunity and on the code of ethics for computer scientists) in the scenario exercises.

The differences between students' pre and post evaluation self-reports results on two items in the scenario exercises indicate that exposure to course contents were a major factor in changing students' perceptions of computing practices.

4) There was a difference between computing majors' and non-computing majors' self-reports results on one item (focusing concern on the people who use the product) in the scenario exercises. This item was different than the two items identified in the overall student responses.

Therefore, it is concluded that by comparing the responses between majors from the scenario exercises it showed a change in perceptions after course instruction. Even though the comparison of computing and non-computing major groups' self-reports responses in the scenario exercises yielded a different result, the outcome was the same: the scenario exercises indicate that exposure to course contents, for majors, was a factor in changing their perceptions of computing practices.

5) There was a difference in students' pre evaluation and post evaluation self-reports results on one item category (Better Computer Science) in the National Science Foundation exercise.

The difference in responses between the pre and post evaluation self-reports results on one item in the National Science Foundation exercise indicate that exposure to course contents and topics were factors in changing students' perceptions of computing practices.

6) There was a difference between computing majors' and non-computing majors' self-reports results on one item category (Ethical and Social Issues in Information Technology) in the National Science Foundation exercise.

Therefore, it is concluded that by comparing the responses between majors, it shows that the National Science Foundation exercise was instrumental in changing majors' perceptions after course instruction. Even though the comparison of

computing and non-computing major groups' self-reports responses in the National Science Foundation exercise yielded a different result than overall student responses, the outcome was the same: The National Science Foundation exercise indicates that exposure to course contents and topics, for majors, were factors in changing their perceptions of computing practices. The researcher assumes that this result could be attributed to the fact that non-computing majors have less exposure to some computing topics, which might indicate the perceived difference in awareness of ethics.

7) There was no difference in students' pre evaluation and post evaluation self-reports ranking computer topics/issues. Therefore, it is concluded that students maintained the same perception of computer topic/issue importance before and after the ethics course.

8) There was no difference in students' pre evaluation and post evaluation self-reports ranking a list of computer courses. Therefore, it is concluded that students maintained the same perception of computer course importance before and after the ethics course.

9) There was a difference between computing majors' and non-computing majors' self-reports results on ranking a list of ethics courses. Therefore, it is concluded that between major groups' self-reports responses, which showed the listing of computer courses by importance exercise, was successful in changing majors' perceptions after course instruction. The researcher asserts that this result is indicative of exposure to computing topics and computing experiences of the student.

10) There was no difference in students' pre evaluation and post evaluation self-reports responses to the importance of the ethics topics in computing. Therefore, it is concluded that students maintained the same perception of importance of the ethics topic in computing before and after course instruction.

11) There was no difference between computing majors' and non-computing majors' self-reports responses to the importance of the ethics topic in computing. Therefore, it is concluded that computing majors and non-computing majors maintained the same perception of importance of the ethics topic in computing before and after course instruction.

The researcher asserted that after experiencing the ethics course contents, students' perceptions of ethics and computing will differ from the perceptions before course instruction. The researcher wanted to find out if students perceived their understanding of ethics and computing differently after exposure to the contents of the ethics course. The researcher did not want to specifically define or address, at this point in the research, the types of differences experienced by the student only a perceived difference.

Based on self-reported data:

1) The majority of students' self-reported that the discussion course activity assisted them in becoming more aware of ethics. Therefore, it is concluded that this course activity was successful in increasing students' perceptions of ethics.

2) There was no difference between computing majors' and non-computing majors' self-reports in which course activity assisted them in becoming more aware of ethics. Therefore, it is concluded that computing majors and non-computing

majors maintained the same perception of which course activity was successful in increasing their awareness of ethics.

3) The majority of students' self-reported that the course content very much increased their awareness of ethics in computing. Therefore, it is concluded that the overall course pedagogy was successful in increasing students' awareness of ethics in computing.

4) There was no difference between computing majors' and non-computing majors' self-reports on whether the course content increased their awareness of ethics in computing. Therefore, it is concluded that computing majors and non-computing majors maintained the same perception of course content before and after course instruction.

5) The majority of students' self-reported that the following class exercises assisted them in increasing their awareness of ethics: lectures, discussions, and case studies. Therefore, it is concluded that the overall course pedagogy was successful in increasing students' awareness of ethics in computing.

The researcher has found in her years of teaching this course that students respond differently to a variety of course exercises and activities. Based on verbal feedback from students, most indicated that class discussions were their favorite. In class discussions, the researcher addresses various "hot-button" issues in computing, such as pornography, software piracy, social issues, hacking, security and privacy. Class discussions generate from debates, games, plays, and lectures.

5.3 Recommendations (Overall Assessments)

Based on the analyses of the data and conclusions derived from the analyses, various aspects of this study were very encouraging and enlightening. One of the most enlightening aspects was the positive feedback from students regarding the application of the four-step analysis tool approach to decision-making. The inclusion of this process was very instrumental in students applying a systematic approach to ethical decision-making in computing. If such a result leads to students' better understanding of ethics in computing, then it would be beneficial to include this approach as a standard format in an ethics course. In addition, this would be advantageous for computing curricula and accreditation boards to include as standard criteria for computer ethics courses. It should be noted here that the students are not using the moral theories to justify their decisions, but as a way of viewing a situation from another perspective, which the moral theories provide.

Another encouraging aspect was the positive feedback from students regarding the pedagogical structure of the ethics course. This was encouraging to the researcher based on her ethics course content. Since there is so little information regarding the content and structure of a computer ethics course, this information would be very helpful to computing faculty and curriculum development. Finally, the feedback from students' perceptions of changing their awareness of ethics in computing after taking the course was very informative. Students reported that the ethics course changed their awareness of ethics in computing. This is very important, given that, if the ethics course leads students to perceive a change of awareness, it

would be beneficial for computing curricula to evaluate when this course is offered in the computing curriculum.

The fact that few differences existed between the responses of computing majors and non-computing majors indicated the universality aspects of the ethics course. Though the size of the population in this study was small, it is imperative to report the differences and non-differences in perceptions between these two groups. These results are very important to the researcher for future reference in course development. Moreover, these results would be informative to computing curricula in developing different offerings of computer ethics courses and modules.

After the results of this study, the researcher is encouraged to find several indications of validation in ethics course content, delivery, and focus. Moreover, the researcher collected additional information from this research that gives her more understanding, from a student's perspective, on teaching ethics.

5.4 Suggestions for Future Research

This research covered a variety of analyses and comparisons; however, there are many more approaches that were not the focus of this study which are worthwhile to be explored by future research. For example:

Because of the limited scope of this study, it would be beneficial to expand this study to cover more semesters and more course sections. A larger population result could yield different results from what is reported in this study.

This study was conducted in a four-year computing program. It would, also, be useful to collect data and perform analyses from two-year computing programs.

This study did not look into perceptions of the computer ethics course based on ethnicity and gender characteristics. The focus of this research was based on the students' perceptions of the ethics course based on major characteristics. It would be beneficial to do further analyses and comparisons on the perceptions of the ethics course based on these characteristics. Bohy's (2003) doctoral dissertation researched students' perceptions of ethics and professionalism in computer ethics. However, his research is based on ethical and professional practices in computing. This study did not specifically focus on the impacts of the four-step tool on decision-making. Based on the results of students' perceptions on the four-step decision-making tool, it would be valuable to research this further to gain a better perspective of the effects of this approach in the computer ethics course.

As mentioned earlier in the section entitled, Predicted Limitations of the Research Study, this study did not examine the consequences of previous ethics courses taken by the student. It would be interesting to investigate the differences between students who have taken an ethics course and those who have not prior to taking the computer ethics course.

The research focused on the researcher's ethics classes, which only addressed the methodologies used in her classes. It would be valuable to compare the differences between the researcher's course methodologies to other ethics course methodologies.

All of the above suggestions for future research indicate that there is a continued amount of information to be investigated on this topic. It would be of

extreme importance to the computing curricula development, as well as other academic curricula development, to continue study in this area.

5.5 Conclusion

The limited research in this area has not examined this topic from the viewpoint of the student. A major strength of this study is the contribution of self-reported student's perceptions of an ethics course. It is the firm conviction of this researcher that this study adds a tremendous value to the foundation for further assessment of computer ethics.

APPENDICES

Appendix A

Pilot Study Interviews

Student: Craig

BEFORE TAKING THIS CLASS, HOW AWARE WERE YOU OF ETHICAL ISSUES INVOLVING COMPUTER TECHNOLOGY?

Believe it or not, it never crossed my mind. I just thought that it was something everybody was doing. It was something either is hard to be caught, if I was doing something wrong, or, everything we were doing was legal. So many people using the computer, you would never get caught. I never done anything, I know, illegal on a computer, you know. Now, they got all these work rules with anything you do in your office with a computer is on company's time and they could do whatever they want to search and see if you not doing your job, instead of what you suppose to be doing. I know they have an Internet policy that you are not allowed to do business for your own—like banking, shopping online, and things like that. We talked about the "Big Brother" thing we did in paper for you. It's a "Big Brother" thing; they can see what you are doing anytime they feel like it. They use Net-Meeting, where they can control your computer if you are having problems. You know, these people are in Montreal, Canada doing these things. There are people watching us. [AS YOU WERE BEING CONFRONTED WITH THOSE ISSUES ON YOUR JOB, DID YOU ASSOCIATE THE TOPIC ETHICS WITH YOUR SITUATION?] No, but since class you can feel it and sense it. I handle myself different on the job. I try to explain to others what the law is. The only thing before that issue was Pornography. And they had software filters on our Internet.

AT THIS POINT IN THE SEMESTER, HOW DO YOU FEEL ABOUT YOUR ABILITY TO MAKE ETHICAL DECISIONS INVOLVING COMPUTER TECHNOLOGY? WHY?

When I first started class, I had separate ethical feelings for the computer and separate social ethical feelings. I never thought they intermingled until I took the class. And, now I have children that download music off the Internet, now I know it is illegal. I try to stop them when I'm around. I don't do much thievery on the Internet and steal things or try to hack or anything. But, the laws, to me, whatever pertains to the social environment—the laws for man should be same for the Internet. Copyright, malice, and the things we're talking about right now, even the case study I have now, you know, I don't think there should be separate laws for the Internet. But, it seems a lot people want to push, because it so vast and it's going to be hard to catch people. But, there are people, police units that deal with this sort of issue. [DO YOU FEEL YOU COULD MAKE A MORE THOROUGH ETHICAL DECISION, SO FAR IN THE COURSE?] Before this class, I was taking a multimedia class, where you got to use a software program for 30 days. People at work was saying I can get you the different kinds of numbers you can use that would let you use the software like you own it.

Before this class, if someone were to tell me to go get code so I could get all this software for free, I would not have any feelings of stealing someone's money. These programs can cost $400-$600. Now, I wouldn't dream of doing it.

WHICH CLASS EXERCISE DID YOU FEEL ASSISTED YOUR UNDERSTANDING IN ANALYZING ETHICAL ISSUES? HOW?

The mock play of the Dean and Pornography enlightened me a whole lot because there were a lot of social issues around a computer ethical problem. The guy wanted more hard space for his pornography and how it leaked to the papers; that made me think of how to think logically. I enjoyed that. Another thing I enjoyed, was taking the four-step process in how to make an ethical decision, where half the time I would do the opposite when I first read the question. After going through the analysis of the different theories of the philosophers, it changed my mind. Like when you start thinking of the "good of the group" and "least harm for the group", I find myself at work trying to get people to think the same way. Like, 'cause you think it's best for you, may not be best for the company. And I'm starting to interact and use these thought process, which people don't use at work, because it's spontaneous for a person—what's good for this person. [HAS IT BEEN SUCCESSFUL?] It's successful with upper-management, but with my peers, they don't understand. The subordinates, lower employees, they do whatever you say. So, I'm having problems with the peer group.

DO YOU FEEL THAT ETHICS IS RELEVEANT TOPIC FOR A COMPUTING CURRICULUM? WHY? OR WHY NOT?

I think everybody should have an ethics class. No matter what field they want to make money in. Because, I just think it makes you a better person. Everybody should be working on the same ethical rules, especially with computers being so new. I would always think that there were no rules for it. You had all this power and nobody could see what you were doing because you were in the privacy of your own office or at home. Now, I just think that it is business ethics, but like I learned, all these ethics just carry over. You don't have to re-write the ethics, just change the words in sentences to change from a store's business ethics to a computer ethics. [SO, YOU WOULD SAY ETHICS IS APPLICABLE TO ANY AREA?] That's what I feel now, before I thought there were different rules for computers, different rules for driving a car, you know.

HOW HAS THIS COURSE HELPED YOU BECOME MORE AWARE OF ETHICAL ISSUES INVOLVING COMUTER TECHNOLOGY?

Are we talking about work or home? [IT DOESN'T MATTER WHERE.] Plagiarism—I do have to write a lot. And, I never thought about it. I just always used the M.L.A. style of giving credit where credit is due. Usually on my papers or works, I give credit where credit is due 'cause I couldn't think of half these things these guys write about. So, I thing plagiarism plays a big role in computer ethics.

And, the other ethical issue, for me, at work, is: What I'm doing on company's time that I'm doing to serve myself so that I don't have to do it when I get home? And when we were in the control room, a big room, we would just play computerized chess and different kinds of games, believe it or not, when nobody was around. And, now I feel differently about all that because I think the employees can spend better time of making sure all the files were updated. Everything is done by computers now, and I don't see how anybody has extra time to play games at work anymore. Years ago, on the eleven-seven shift, it was no big deal.

WOULD YOU RECOMMEND THIS ETHICS COURSE TO OTHER MAJORS? WHY?

Yeah, because the computer is use in any kind of degree program you are taking or any kind of work you are associated with, unless you are common laborer. Even if you were a common laborer you would want to know something somewhere, like where you can find some work.

Student: John

BEFORE TAKING THIS CLASS, HOW AWARE WERE YOU OF ETHICAL ISSUES INVOLVING COMPUTER TECHNOLOGY?

A little bit. [IN WHAT WAY?] Uhm…Well, for instance, I thought about what I was doing and how ethical it was. [CAN YOU GIVE ME AN EXAMPLE?] Most examples would be, you know, the huge RIAA, the whole downloading stuff, pirating software, is probably the biggest, you know. I've done that plenty. (Laughs) I won't lie about it. [OKAY. YOU THOUGHT ABOUT ETHICS WHEN YOU WERE DOING THIS?] Yeah, and I made up my own excuses as to why it was okay for me to do this. [IN YOUR PREVIOUS COURSES, DID YOU HAVE ETHICAL MODULES INCORPORATED IN THE CLASSES?] No. The teachers don't go over the ethics in the courses, but they don't promote ethical activities. If you were to say to the teacher, "What if I go and download Microsoft Studio Visual 6, real quick? And they would go, "Well, I don't know about that. We have it up in the lab for you to use, you know." [IS THAT THE EXTENT OF THE CONVERSATION?] Yeah, they don't promote it.

AT THIS POINT IN THE SEMESTER, HOW DO YOU FEEL ABOUT YOUR ABILITY TO MAKE ETHICAL DECISIONS INVOLVING COMPUTER TECHNOLOGY? WHY?

I feel that I have a great ability to do that- to make ethical decisions. And, I feel that I have really learned a lot about what that really means in making an ethical decision. But, I don't know it still my human wants and needs that make my decisions. [ARE YOU SAYING THAT YOUR KNOWLEDGE ABOUT MAKING ETHICAL

DECISIONS HAVE INCREASE, BUT YOU STILL HAVE A CONFLICT IN MAKING THESE TYPES OF DECISIONS?] Yeah, I learned what an ethical decision really is and how that contributes in what is right and wrong. I really thought a lot more about it, you know. Especially, like in the case that we're doing now. My case study is about what's right and wrong. If you think something wrong, maybe it is not unethical, you know, all that kind of stuff. [IF YOU WERE WORKING IN A COMPUTER FIELD, WOULD YOU APPLY ETHICAL DECISION MORE OR LESS THAN YOU WOULD AS A STUDENT?] I think it's very important to be ethical on your job, you know. 'Cause in that part, you not only representing yourself, but the company you're working for. So, you know, I would definitely have to. You don't want to hurt the company. That's even worse than taking yourself down. [WOULD YOU WANT YOURSELF TO BE PERCEIVED AS AN ETHICAL PROFESSIONAL?] Definitely, I see, even in my life, I'm trying to make my computer choices, you know, more ethical. And try to do the right thing when it comes to different tasks I have. [OKAY.] Like, I'm not pirating software anymore. I'm trying to get rid of all the stuff on my computers right now and trying to get legal copies of everything. So, it's good. I'm getting there.

WHICH CLASS EXERCISE DID YOU FEEL ASSISTED YOUR UNDERSTANDING IN ANALYZING ETHICAL ISSUES? HOW?

I have to say the packet of worksheets you gave us, that have you go through the steps. [OH, THE FOUR-STEP ANALYSIS WORKSHEET.] Once you taught us everything in it, it was an easy way to have everything side-by-side. Like, you had to follow every step to see why it builds up the way it does. And, once you have, I think, Step III, where you have all the theories all next to each other, you can see once you do Step IV, they all compare. And each one looks at the dilemmas, and how you can use each one to your advantage or disadvantage. [OKAY. SO, THAT PART HELPED YOU IN ANALYZING ETHICAL ISSUES. ARE THERE ANY OTHER EXERCISES THAT HELPED YOU?] Uhm…Also, doing it with my group members. Hearing their ideas. That helps with a lot. [THE DIFFERENT PERSPECTIVES?] Yeah, I like all the group discussions we have. They really help out a lot, because you get to hear everybody's ideas. It helps a lot when everyone opens up in class, you know, and really start talking about it. You hear somebody in class like, Michael, who takes the other stand, and you understand why they would make the other choice. And you can think about that a little bit more, and whether or not you would do it.

DO YOU FEEL THAT ETHICS IS A RELEVANT TOPIC FOR A COMPUTING CURRICULUM? WHY? OR WHY NOT?

I definitely feel it is, because I think your ethical behavior will attribute to whom you work for and where you work. I don't think companies want someone who is not ethical about their decisions. Like, let's just say I started stealing music and downloading software and stuff like that, I don't think the company would look highly at me in a good light, you know. [OKAY, LET'S SAY YOU GO ON A JOB

INTERVIEW AND THE EMPLOYER LOOKS AT YOUR TRANSCRIPT. DO YOU THINK IT IS A PLUS FOR YOU THAT THEY SEE YOU TOOK AN ETHICS COURSE?] Uhm…I really don't know. If I were the boss, I wouldn't want someone that is unethical. Like, if you were to see that someone has been arrested before, and then you would go, I'd don't know if I want that. But, I know employers in computing field they just go down and see how many languages do you know and what kind of operating systems are you experienced with and what kind of software you are experienced with. I don't know what classes they really look for. [IF YOU WERE GOING IN THE FIELD OF SOFTWARE ENGINEERING, WHERE YOU ARE DEVELOPING AND IMPLEMENTING DESIGNS, DO YOU THINK ETHICS IS A BENEFICIAL COURSE TO HAVE?] I definitely think it is beneficial. I think it is almost expected for people to have an ethical decision-making process, you know. I think it's something you need to have, that's why I took this course.

HOW HAS THIS COURSE HELPED YOU BECOME MORE AWARE OF ETHICAL ISSUES INVOLVING COMPUTER TECHNOLOGY?

Uhm… [HAS ANYTHING IN THE COURSE ENLIGHTENED YOU, OR MADE YOU MORE INTERESTED IN OTHER AREAS INVOLVING COMPUTING?]

The video, we saw. [WHICH ONE?] The Hate.com video. That was pretty powerful. [IN WHAT WAY?] Uh…I really didn't know that that existed. [YOU DIDN'T KNOW HATE SITES EXISTED?] Well, I knew that they were there, but not in that force, not in that kind of strength that they have. It was kinda of scary. [AND, THAT INTERESTED YOU? IN WHAT WAY?] It didn't make more interested, but more conscientious, like I shouldn't take those things lightly. What else? Like the case studies we've done were interesting. Especially the one we're on now. Just reading about all that stuff. I didn't know all about the laws. It's really interesting to see how the law processes work. And, I thought, like over all, we've will be able to solve a problem. And, then I read about this law and it's kinda interesting. Like, I would think, how would I re-write that law to make it work and it's really hard: 'Cause that is what we're going to have to do in our papers. How could we fix this? To find an actual solution is not an easy thing to do. That's interesting to me, finding a solution to a problem. It's not easy at all. In the case, we're arguing back and forth about what we should do and how we should do it. And even in arguing, I feel bad about some of the points I have to make. [WHY?] Because, with child pornography, I don't think any of it should be legal, but then again, like some things, I'm like, well if we're going to make it an ethical decision and we're going through this whole thing about why we should make different classes of pictures legal and like, we have to make some of them legal so they can use it more than one way. I don't know. That's the whole thing: Should we make them legal? Should we not make them legal? I feel bad if I advocate for either side because, it's like, I don't know. [WOULD YOU USE THE FOUR-STEP ANALYSIS IF YOU CAME ACROSS A SIMILAR PROBLEM ON YOUR JOB AS A PROFESSIONAL?] I could try to do that. And, I don't know, I guess I would have to try it. But, I think that method helps me see the different ways you could think about one problem, but it's most useful in a group environment,

where several people are discussing it all. Because, I know for a fact, I can't think of all different viewpoints and I need somebody to play off on; at least, to talk to while I'm trying to figure it out myself. This method has been helpful because I thought about who the stakeholders are. That's an interesting topic, because it is a lot more than you think. On our last project, we were like, oh, the U.S. government is even a stakeholder in this. And, we had to go back and revise the beginning of our paper to see how the government fits into everything. It's interesting to see how many people are affected regarding any decision you make.

IS THERE ANY THING, YOU CAN THINK OF THAT COULD IMPROVE THE COURSE, OR ADD TO THE COURSE?

Uhm… That's a tough question. I love the group discussions. It's hard to have more of them, because you can only have so much group discussions, but then again, you only have so many people talking. It's hard to get the whole class involve. [DO YOU MEAN SMALL GROUP DISCUSSIONS OR DISCUSSIONS WITH THE WHOLE CLASS?] The whole class: I love the whole class discussions.

Student: Michael

BEFORE TAKING THIS CLASS, HOW AWARE WERE YOU OF ETHICAL ISSUES INVOLVING COMPUTER TECHNOLOGY?

I was interested in the ethics aspect of this course. Ethics is something that always interested me because I always have done a lot of reading. Reading is my passion. History is my first love and I always read everything I could get my hands on. I did a lot of readings on Martin Luther, Thomas Aquinas, Kant, and I figured that this course would not be too far from that basic direction. So I figure that there are no easy courses in college, but at least it would meet with my interest. [HAD YOU THOUGHT ABOUT ETHICS IN REGARDS TO COMPUTER TECHNOLOGY?] Not specifically. I feel that ethics, as a field, is either you have them or you don't. Ethics as field gives you choices-right or wrong and although nothing is really in black and white there are always shadows and different facet of events and of issues.

AT THIS POINT IN THE SEMESTER, HOW DO YOU FEEL ABOUT YOUR ABILITY TO MAKE ETHICAL DECISIONS INVOLVING COMPUTER TECHNOLOGY? WHY?

Well, this course has exposed me basically, to the technicalities of the ethical issues that are involved with computer technology; and, issues that previously did not exist, necessarily, because of the technology involved. All that technology really has done is rear the ugly head of ethics to higher level. Not necessarily ugly, but raised the bar of ethics to a different level. And, I feel that the class has helped me to state, has helped me to individualize sectors or issues that I did not particularly think of just by

themselves. The process that allows me to determine the righteousness or wrongfulness of an issue is still basically the same, but I feel that the class has helped me to see what the problems that new technology has brought about.

WHICH CLASS EXERCISE DID YOU FEEL ASSISTED YOUR UNDERSTANDING IN ANALYZING ETHICAL ISSUES? HOW?

Well, the explanations of the processes that you brought forth in class—the deontological perspective, the Kantian perspective and all the other perspectives that you insist that we go through in analyzing issues are basically new to me. Because, I'd never really thought of analyzing a subject or an issue as matter of process. And that's what I think the school does; the college-level course requires you to go through the hoops, sort of speaking. And to me, previously it was always a much easier process—whether it was right or wrong-done. It's helps me to be more deliberate and not taken by the first instinctive response. It helps me be more reflective on the possible causes and possible ramifications of each case, instead of going to input-output-gone.

I really appreciated the lecture that we had from the gentleman on the counterfeiting and security issues.

DO YOU FEEL THAT ETHICS IS RELEVEANT TOPIC FOR A COMPUTING CURRICULUM? WHY? OR WHY NOT?

Occasionally you have seen, by some of the ethical questions you have asked in class and some of shameful answers you got [from] the kids, I'm 51-years old so I have a totally different perspective than most of the students in the class. Most of the time when the students answered candidly, students responded in ways that were absolutely unethical, in my estimation. I think ethics should be mandatory in a secular society, as ours has become. Because people have to be made aware that there are consequences to bad behavior and if you don't have a religious background (any religion) then ethics is going to take a second place in society and people are going to act for their own benefit; what benefits me right now. Ethical issues helps you overcome that mindset, in my opinion. So, whether your course is in Education, Computers, Social Studies, or Anthropology, ethics should always be in the forefront in how you interact in your personal relationships and society.

HOW HAS THIS COURSE HELPED YOU BECOME MORE AWARE OF ETHICAL ISSUES INVOLVING COMUTER TECHNOLOGY?

By exposing me to case law and by exposing me to different facets of legislation. As you are aware, my group is working on right now, the Child Pornography Protection Act, which is a misnomer in my opinion. But, that's just what Washington does; they put nice labels on laws. It's not a law that protects against anything; it just gives punishment afterwards. It has exposed me, as I was saying, to the different facets of

ethical issues as they apply to legislation that has been passed. We discussed in class, I remember, the Sonny Bono legislation, another elegant, splendid piece of legislation that was brought by and paid for the Walt Disney Corporation in order not to lose their valuable franchise—mouse ears. The copyright law is a good thing for everyone that produces copyrighted material, but at the same time, you have major software corporations that are continuously copyrighting minuet advances in their codes or in their programming, making it basically impossible for anybody to make advances or make any changes. They are strangling the Patent Office and they are strangling any possible innovation, as well, because they're size dwarf anyone who wants to get in the field. Those were just some of issues that we were exposed to that I found very interesting. I had not thought much personally about those issues. I felt much enriched being of be able to directed to look at those examples.

IN WHAT WAYS, WOULD YOU SUGGEST TO IMPROVE THE COURSE?

A weekly outing to Outback Steakhouse? [LAUGH] The subject matter is so vast that I could suggest covering this other sector of the industry or explore this sector more, but really, like everything else in a school environment, the Teacher has time constrictions. So, if the student is interested in the subject, he given a wealth of material that he can mine for his learning as well as for his benefit. As far as what could be added? If you add something, you would have to take something away. I feel that enough subjects are being touched on and explored in sufficient depth that basically, I would be loath to remove the things we have done so far in favor of to make any of the subjects we touch on so far removed or to get in more in depth. Everything we have done thus far has been revealing, I feel for my learning to spur my interests and thinking.

Student: Olla

BEFORE TAKING THIS CLASS, WERE YOU AWARE OF ETHICAL ISSUES INVOLVING COMPUTER TECHNOLOGY?

Yeah, I did, at some point. Especially when, I felt like my computer was being, you know, …I was getting all sorts of ads and all that.
And, I would get e-mails, where my password would be used as my name. So, I knew something weird was going on. I, kinda, like got a little bit concern, you know. But, I really didn't do too much about it. So…when, I heard about this course, I thought, maybe I can learn something I didn't know.

WHEN YOU WERE HAVING PROBLEMS WITH YOUR COMPUTER, DID YOU EQUATE THAT WITH ETHICS? LIKE SOMEONE DOING SOMETHING WRONG—MORALLY WRONG, MORALLY RIGHT?

Basically, I thought I was being violated, that was it, because it was my password being used as my name. So, I kinda felt really violated, and…but… the truth is I don't know a lot about the Constitutions concerning…you know, the computer world around here, really. So, I thought this might just be a good opportunity to learn some things I don't know…and basically, that was is it.

OKAY. AT THIS POINT IN THE SEMESTER, SINCE WE ARE AT MIDPOINT, HOW DO YOU FEEL ABOUT YOUR ABILITIES IN MAKING ETHICAL DECISIONS REGARDING OR INVOLVING COMPUTER TECHNOLOGY?

I think…uhm…especially with the course; it definitely has helped me in a lot of ways. Like, for example, the, you know, the common KaZaa thing. I will tell you that I have…I had it on my computer for a little bit…I downloaded it on my computer for a little bit and then, after I heard all this and all that, I actually deleted it from my computer. I think that, besides the fact that I've been thinking about that, I know the class has really helped me in that area. I, also, learned, you know, I learned…uhm…about, like you know, we've been talking about deontology, and the Kant theory, and all that. It kinda gave me a little bit more insight into the old ethical issues, which I'm, really am for, you know. I definitely support. So, that's definitely helped me as a person, too.

GOOD. WERE THERE ANY CLASSES EXERCISES, TO DATE, DO YOU FELT ASSISTED YOUR UNDERSTANDING IN ANALYZING ETHICAL ISSUES? WHICH ONES? AND, IN WHAT WAY?

The last project we did in class really helped. [WHICH ONE?] We talked about Intellectual Property. Uh…that definitely…I remember in my group, we talked. Our question was: Should Intellectual Property be, I think, Should Software be protected? Should it be allowed to be protected? And, that kinda, uhm…I figured that in the…. I remembered in our group that it should. Just because, that way, people, who would be encouraged to make software better and also, uhm….you know, to (undecipherable) how people use it and all that. And, less hackers into the system, so. That kinda gave me a lot of insight 'cause we sat together in my group and we discussed it. Even though, it was not all we discussed, that we used in the project, but I learned from a lot of my group members, you know. They talked about the Constitution and the laws and everything. And that really gave me a lot of insight. It really helped. [SO, YOU ARE SAYING THE INTERACTION WITH YOUR GROUP MEMBERS, GETTING THEIR PERSPECTIVES HELPED YOU?] Yeah. Right. [SO, YOU ARE SAYING THE CASE STUDY, REALLY HELPED YOU AND THE INTERACTION WITH YOUR GROUP MEMBERS?] Yeah. Right. [ANY OTHER EXERCISES IN THE CLASS?] Definitely, a lot more helped. I liked the presentation by Dr. Lavine. I particularly liked that; it gave me a lot of insight, as well. [HOW DID IT GIVE YOU A LOT OF INSIGHT?] I remember he talked about computer security, and, you know, he told us stuff about how people, you know, use other people's……There were sometimes I didn't know, you know, when something when you not part something, you probably don't know what is

happening. You kinda just feel safe. Letting your computer be to an extent. So, when he talked about all that, you know, and how to be careful…. He actually also aroused my interest in computer security and all that. That kinda made me…. It's like I'm yearning for more. I want to know more about this part of the whole thing. It sounds like I found something interesting in computers and I want to know more about it. [SO THE AREAS OF SECURITY AND ETHICS OPENED UP A NEW INTEREST FOR YOU IN COMPUTERS?] Yeah.

[HOW DID YOU FEEL, IN THAT REGARDS, TO PROF. LAVINE'S PRESENTATION, WHEN HE PRESENTED ABOUT THE CHOICES WE MAKE? HE SAID THAT THE CHOICES WE MAKE NOW CAN AFFECT US DOWN THE LINE, SO WE HAVE TO BE CAREFUL.]

That was in reference to? [GETTING SECURITY JOBS. REMEMBER?] Oh, yes, yes, right. Yeah, I think he was really interesting, like when he talked about, you know, about hanging with the wrong people. You might be a good person, but because you hangout with the wrong people and they did stuff that was wrong…which just might rub off on you somehow or get you. And I think that was really helpful because he said something that you might be a good person that might get involve with the wrong people. And I think that from take if just you learn just to be ethical about a lot of things we do, that would definitely help us, especially like if you are going into security. Which, I kinda am more conscious about all the things…I just might get into this part. So, you know, I want to build towards it and all that, you know.

DO YOU FEEL THAT ETHICS IS A RELEVANT TOPIC FOR A COMPUTER CURRICULUM? Definitely. AND, WHY? OR WHY NOT?

[BEFORE WE GET INTO THIS QUESTION, WHAT WAS YOUR MAIN FOCUS WHEN YOU DECIDED TO GET INTO COMPUTING?]

I did not know a lot about computers before I got here. The best I did, you know, the Internet was just coming to Nigeria. So, I was privilege enough, to work in a Cyber Café. [Um] Yeah, so that was what actually aroused me interest in computers. We had a computer at home, but it just all about Word and whatever. When I worked there it was all about the Internet thing and that was, you know, we had cases…I want divulge a little. [THAT'S GOOD.] We had cases about…I don't know if heard about the Nigerian 419 Syndrome? [NO.] You haven't heard about it? [NO, TELL ME ABOUT IT.] Okay, it's like people will send scams like letters to you and tell you their…. of course, you don't know who they are because of the computer they use different e-mail addresses…and, they will send you letters saying they have some money that they are trying wire to the United States and they need an account number. They will tell you that the past President…We had this President who had a lot of money. Then he died. So, they tell you that they are the past President's relation. You know they know so much about this guy so they will impersonate him and tell you if you could give them your account or something they have this large

amount of money that the Nigerian government wants to seize. But they want to get it out of the country and they don't leave here so they need an account number to help them out. I just think it's greedy for people to fall for it. Why would I give someone I don't know my money? That's actually the basic thing that happens. [THAT'S INTERESTING, SEEING THAT TECHNOLOGY IS BEGINNING TO GROW IN NIGERIA AND THERE ARE ETHICAL ISSUES ALREADY INVOLVING.]

[SO, GETTING BACK TO THE QUESTION: DO YOU FEEL THAT ETHICS IN A RELEVANT TOPIC FOR A COMPUTING CURRICULUM?]

Definitely, I do. Like I said after I saw all that was happening, I wanted to know more about computers. Because, at the time I was helping a friend manage the Café and there was no way we could stop the scams because they were our paying customers. They paid to come and use the computers and we couldn't like, nose into what they were doing. We couldn't stop them, but we knew what they were doing was wrong because they were sending out scams. But, you know we had to make our money, we were just starting out. But, I was always so concerned; I never liked it because people fell for this. So, I start to wonder how could we block those people from….Like, they think they sent the letters, but…let's just have something that would block their mail. But, definitely, I got very interested the Internet and I wanted to come study abroad. Of course, somewhere along the line, I knew that ethics was definitely somewhere in my head. So, going back to the question, I know that ethics is definitely important for a computer curriculum because , I think one major problem in the computer….Wait, let me put it this way, people are not very aware of….a regular person is not aware of….everyone uses the computer. They are not aware of a lot things. They do not think a lot of things are wrong or…They just think, well, just as long as you have a computer and that you can use it, that's fine. But, there is so many things, like especially with ethical issues, the problems with downloading, spyware, and all that. But, people don't realize that this is a problem. Perhaps they just find out one day that the computer has crashed and they don't know why. You know, they probably are getting e-mails that have stuff attached to them. So, definitely I think people should be enlightened about ethical issues and security and how, you know…and, just kind of class I really definitely think people would get enlightened about a lot of things. I'm glad it is a Gen Ed, where it's not only for computer majors, but other people in other fields could also learn something. So it is very important.

HAS THIS COURSE HELPED YOU BECOME MORE AWARE OF ETHICAL ISSUES INVOLVING COMPUTER TECHNOLOGY? HOW?

Yeah. Okay. One, I know that I learned the Constitution where there was so much freedom of speech and all that. I wasn't so aware of that, but after taking this class, I learned that and…uhm…but at the same time, I learned that there had to be a balance. And then, I also learned that, of course, I learned about all the downloading issues. So basically, this class has really helped me, and you know, how the security thing, and..I say about security, this class has really been helpful. If anything, it has shed a

new kind of light. Okay, I found another part 'cause, so far so good. 'Cause I tell you that in my little computer years here, I have been really scared of programming. I thought that was all I had to do. So, I was kinda like, uhm…I have to find another part to this thing 'cause I really don't think I like programming. So, after I heard all that I said it sounds like something I might want to do. So, it has definitely helped.

EVEN THOUGH WE ARE AT MIDPOINT IN THE SEMESTER, DO YOU HAVE ANY SUGGESTIONS ABOUT WHAT COULD BE ADDED TO THIS COURSE IMPROVE?

First, I like the speakers coming in 'cause it brings a lot of diversity to the whole thing. And, yeah….uhm…lets see…[ANYTHING YOU WOULD LIKE TO SEE IN THE CLASS?] I pretty much like the package of the class. At some point you get to work alone, the final paper, you get to work alone. The only other thing I just might think of….I might suggest…okay…uhm..If you make people prepare for….like you might wanta…let me put it this way….You make people research on ethical issues they know about, you know, about ethical dilemmas around…just like come and talk for about five minutes about it in class. You know…its like…its going to be a one person thing…its not going to be a group thing. It might want to make you want to research on your own, in as much as you have your group work. So, this might help. It's not going to anything with reading, just tell us about your experience…it might be an ethical issue…it might be something your came across on the Internet. I thought, make you do some little work on your own. [OH, THAT'S GREAT!]

Student: Robin

BEFORE TAKING THIS CLASS, HOW AWARE WERE YOU OF ETHICAL ISSUES INVOLVING COMPUTER TECHNOLOGY?

Uhm… Nothing, but the music; because it was made very public. So, other than that I really hadn't thought about. [THE DOWNLOADING OF MUSIC?] Yeah, the downloading of music. [YOU ALSO, HAD MY CLASS, 111, WHERE I WENT OVER ETHICS. DID THAT GIVE YOU ANY INSIGHT OF ETHICAL ISSUES IN COMPUTER TECHNOLOGY?] Uhm…. Yeah, yeah it did, because we went over the different terms of hacking and cracking and all of that stuff that I really didn't know. It also helped with some of laws. I didn't really know. We kinda of went over that. [IN YOUR OTHER COMPUTING CLASS, DID THEY TALK ABOUT ETHICS OR HAVE AN ETHICAL MODULE BUILT IN THE COURSE?] No, not really. I, mean, in a couple of the programming classes, they said if you can find something over the Internet just make sure you document where you got it from. But, it was never the ethics side of it.

AT THIS POINT IN THE SEMESTER, HOW DO YOU FEEL ABOUT YOUR ABILITY TO MAKE ETHICAL DECISIONS INVOLVING COMPUTER TECHNOLOGY? WHY?

I feel that I can make those decisions. I have a very strong religious background and I think that has something to do with it. Uhm… It has helped me kinda help me understand it a little bit better. Like the case studies we go through are very helpful because they are real-to-life. [OKAY, WE ARE GOING TO GET TO FAVORITE CLASS EXERCISES, BUT BEFORE THIS, ELABORATE ON YOUR RELIGIOUS BACKGROUND AND YOUR ABILITY TO MAKE ETHICAL DECISIONS.] Well it gives you a very strong moral background. So, you know right from wrong and you know what you are going to be punished from. [DO YOU THINK THAT THE COMBINATION OF YOUR RELIGIOUS BACKGROUND AND THIS COURSE, YOU THINK MORE THOROUGHLY REGARDING YOUR DECISIONS?] I think so. [GIVE ME AN EXAMPLE.] Uhm…I guess the biggest one is pornography on the Internet. I think it is just an addiction. And, I would do that, and I think it's just too easy for people to get into that. [SO, HOW WOULD YOU STATE YOUR DECISION REGARDING PORNOGRAPHY OVER THE INTERNET?] Uhm…I really like the idea of making a .XXX or some kinda of flag to show that this is an adult site, especially for children. [OKAY.]

WHICH CLASS EXERCISE DID YOU FEEL ASSISTED YOUR UNDERSTANDING IN ANALYZING ETHICAL ISSUES? HOW?

The case studies really helped you put in perspective, like I'm really going to have to deal with this someday. This is not just some class I taking to learn ethics; this is something I'm going to have to deal with. [WHAT'S ANOTHER ONE? JUST KEEP TALKING.] Uhm…I like the book readings. It's nice to have the philosophy side of how other people think about it. It's good to hear how other people's opinions. And the discussions, are very eye opening sometimes. I go, oh, I hadn't thought about that. [THE CLASS DISCUSSIONS, GROUP DISCUSSIONS OR BOTH?] More class discussions, I would say, because you get a broader range of opinions.

DO YOU FEEL THAT ETHICS IS A RELEVANT TOPIC FOR A COMPUTING CURRICULUM? WHY? OR WHY NOT?

Uhm…. Yes, it is relevant because, uhm…. especially with computer and information systems, they lead you more into a management side of things. And, if you are going to be leading a group, you have to have a strong moral side and lead them into a right direction. And, so, I think it is very relevant and I think, especially, college students should hear. [WHEN YOU GRADUATE, AND RECEIVE YOU DEGREE IN COMPUTER AND INFORMATION SYSTEMS, DO YOU VIEW YOURSELF AS A PROFESSIONAL?] Yes. [AND, DO YOU FEEL AS A PROFESSIONAL, ETHICS IS APPLICABLE TO THAT PROFESSION?] Yes.

HOW HAS THIS COURSE HELPED YOU BECOME MORE AWARE OF ETHICAL ISSUES INVOLVING COMPUTER TECHNOLOGY?

It is more of the law side of it. Like, how strict or lose the laws are. I just didn't know. It's not something that you learn in any other class. So, unless you do research on it yourself, you're not going know. So, I think that's the biggest part.

WHERE ARE GOING, AFTER GRADUATION? Right after I graduate, I'm going to Keyway Quality Assurance and Testing. It's a good place to start. And, hopefully, after that I will become a Keyway Manager and after that Product Manager and then CEO. [TESTING IS VERY IMPORTANT, ESPECIALLY IN SOFTWARE DEVELOPMENT AND IMPLEMENTATION.] Yes, I do that right now.

[WE HAD A CASE INVOLVING A MAN IN QUALITY ASSURANCE WHO HAD TO MAKE A BIG ETHICAL DECISION. HOW WOULD YOU MAKE A DECISION IN A SIMILAR SITUATION, SINCE YOU ARE A QUALITY ASSURANCE PROFESSIONAL?] That's a really tough decision. I mean it would take a lot of thought. Uhm…. I guess it depends on if I really love my job. I would try to be very ethical about it and say that it was not going to work. I don't know. [WOULD YOU USE THE FOUR-STEP APPROACH? WOULD YOU TRY TO USE A LOGICAL MEANS TO WEIGH THE DIFFERENT CONSEQUENCES OF YOUR DECISION?] Yes, I would. I don't think I would go through the whole four-steps. But, I think I would definitely go through the logistics map out the pros and the cons. And, whichever way outweighs the other, than that's what I would decide.

IN WHAT WAYS, WOULD YOU SUGGEST TO IMPROVE THE COURSE?

I really like the guest speakers. Like, when Michael Lavine came by, very interesting man. He had so much experience. It was like; you just didn't want him to stop talking. It was like, wow, you have so many great experiences. It was cool to hear him talk about all that. I don't mind the reading and discussing it class. But, to have to sit down and write my opinion it seems a waste of my time. This is just my personal opinion.

Appendix B

Copies of the Pre and Post Evaluation Survey

ETHICS PRE-EVALUATION SURVEY

The purpose of this survey is for the assessment of learning skills and observations before taking this class. The survey results will be used only for academic research purposes. Your privacy will be held in the strictest confidence.

Gender ☐ Male ☐ Female

Course ☐ COSC 418 ☐ COSC 480

Background (**Choose One**) ☐ International Student - List Country _____

☐ Domestic Student - List ethnic Background _____

Towson I.D. **OR** Last five digits of SSN _____

Major _____

Semester and Year (ex. Fall 09) _____

Student Ranking
Please Check Appropriate Box

○ Freshman ○ Junior
○ Sophomore ○ Senior

I. Here is a list of courses. Please rank them in terms of your opinion as to their importance with respect to course content. Mark what course is most important to include in a computer science curriculum with a 1 and the course least important to include with a 10. Sequentially number the remaining courses in terms of their importance until all are ranked. Please give each course a unique number (no ties allowed). If you aren't sure, please guess.

☐ Artificial Intelligence
☐ Data Structures
☐ Database
☐ Distributed Computing
☐ Ethical Issues in Computing
☐ Finite Automata
☐ Graphics
☐ Operating Systems
☐ Software Engineering
☐ Testing and Reliability

II. Before taking this course, I would rate my awareness of ethics in computer technology as:

- ☐ 1 Not aware of the ethical issues involving computer technology.
- ☐ 2 Somewhat aware of the ethical issues involving computer technology.
- ☐ 3 Aware of certain ethical issues involving computer technology.
- ☐ 4 Very aware of the ethical issues involving computer technology.
- ☐ 5 Highly aware of the ethical issues involving computer technology.

III. Which area of computer ethics do you feel holds the greatest amount of ethical dilemmas for the computer professional? CHOOSE ONE.

- ☐ 1 Privacy Issues
- ☐ 2 Intellectual Property Issues
- ☐ 3 Computer Crime Issues
- ☐ 4 Security Issues
- ☐ 5 Social Issues

IV. Choose the statement that best identifies your ability to make an ethical decision involving computer technology before this ethics course.

- ☐ 1 I cannot assess my capabilities and knowledge in making ethical decisions involving computer technology.
- ☐ 2 I don't feel capable and knowledgeable to make ethical decisions involving computer technology.
- ☐ 3 I feel somewhat capable and knowledgeable to make ethical decisions involving computer technology.
- ☐ 4 I feel very capable and knowledgeable to make ethical decisions involving computer technology.
- ☐ 5 I feel highly capable and knowledgeable to make ethical decisions involving computer

technology.

V. Do you feel that the topic of computer ethics:

- ☐ 1 Should not be a topic area for Computer Science/Information Science majors.
- ☐ 2 Is not a relevant topic area for Computer Science/Information Science majors.
- ☐ 3 Is somewhat a relevant topic area for Computer Science/Information Science majors.
- ☐ 4 Is a very important topic area for Computer Science/Information Science majors.
- ☐ 5 Is a highly important topic area for Computer Science/Information Science majors.

VI. Reason for taking this course: (Choose only one)

- ☐ 1. Requirement for major: Computing
- ☐ 2. Requirement for major: Business
- ☐ 3. I feel that it is important to take this course.
- ☐ 4. To fulfill a General Education Requirement
- ☐ 5. I thought the course description was interesting.
- ☐ 6. Recommended by an Advisor
- ☐ 7. I thought the addition of the course on my transcript would give me an advantage for employment.
- ☐ 8. I am interested in the topics of ethics.

VII. The section that follows contains a short scenario. As you read this scenario, imagine that you are the person in the scenario.

SCENARIO:

You work at a software development company, and your company is working on a program that will control an anti-lock braking system for a pickup truck. This software is a considerable advance over previous versions, and will make the brakes even more effective on slippery surfaces. Your main duty is to receive data from software quality control engineers and produce reports for managers about the progress of software testing. While you are producing this month's report, you think there are some discrepancies in the data reported. You discuss your misgivings with the engineer who gave you the data, and he suggests you talk to the department head. You talk to the department head, and she assures you that the data is correct, and asks you to please finish the report as soon as possible. The department head reminds you that she has an advanced degree in computer science (you do not), and that she sees nothing wrong with the data. You are still unconvinced, and worry that the data may hide flaws in the software testing results so far and could lead to consumer injuries. You are considering taking the issue to your department head's boss, who also has an advanced degree in computer science.

Please imagine that you are the person considering taking the issue to the department head's boss. As you pondered your options, a variety of reasons might occur to you that support both going to the department heads' boss and not going to the department heads' boss. Several of these are listed below. Please indicate the extent to which the reasoning in the given statement would influence your final decision.

1 No impact on my final decision.
2 Slight impact on my final decision.
3 Strong impact on my final decision.
4 Very strong impact on my final decision.

☐ The software will improve anti-lock brakes to make them safer.

☐ I don't want to lose my job for doing the wrong thing.

☐ My organization has an obligation to deliver on its promises.

☐ Since I don't have the experience, I need to rely on the experience and recommendations of others.

☐ I would rather avoid being blamed for any trouble that might result.

☐ If I make the right decision, I will be more likely to be promoted.

☐ It's my job to do what most benefits the organization.

☐ People involved in software testing have a responsibility to protect the public.

☐ If I make the right decision, my job performance evaluation will be very positive.

☐ I should follow whatever advice I get from the code of ethics for computer scientists.

☐ It is most important for me to follow the company's rules about who makes what decisions.

☐ We should be concerned about the safety of the people who will drive the pickup trucks.

VIII. You are in charge of the National Science Foundation's new division "BCS: Better Computer Science." You get to distribute $1,000,000 (U.S.) to the following categories. Assume that there are roughly similar numbers of grant applications in each category and that these applications are of a similar quality. Your decision should be based on your judgment of the relative importance of these categories. For each category, write down the amount of money you will grant from the $1,000,000. (The numbers should sum to $1,000,000.)

AMOUNT	**CATEGORY**
☐,000	Artificial Intelligence
☐,000	Biometrics
☐,000	Commercial Off-The-Shelf Software (COTS)
☐,000	Database Management

,000	Ethical and Social Issues in Information Technology
,000	Formal Methods in Computer Science
,000	Image Processing
,000	Networking
,000	Programming Languages

TOTAL SHOULD EQUAL $1,000,000

ETHICS POST-EVALUATION SURVEY

The purpose of this survey is for the assessment of learning skills and observations after taking this class. The survey results will be used only for academic research purposes. Your privacy will be held in the strictest confidence.

Gender ☐ Male ☐ Female

Course ☐ COSC 418 ☐ COSC 480

Background (**Choose One**) ☐ International Student - List Country

☐ Domestic Student - List ethnic Background

Towson I.D. **OR** Last five digits of SSN

Major

Semester and Year (ex. Fall 09)

Student Ranking
Please Check Appropriate Box

○ Freshman ○ Junior
○ Sophomore ○ Senior

I. After taking this course, I would rate my awareness of ethics in computer technology as:

☐ 1 Not aware of the ethical issues involving computer technology.

☐ 2 Somewhat aware of the ethical issues involving computer technology.

☐ 3 Aware of certain ethical issues involving computer technology.

☐ 4 Very aware of the ethical issues involving computer technology.

☐ 5 Highly aware of the ethical issues involving computer technology.

II. How much did the course help you in becoming more aware of the ethical issues involving computer technology?

☐ 1 Not at all

☐ 2 A little

☐ 3 Somewhat

☐ 4 Very much

☐ 5 Highly

III. Did the structured analysis approach used in this course assist you in formulating your ethical decisions?

☐ 1 Not at all

☐ 2 A little

☐ 3 Somewhat

☐ 4 Very much

☐ 5 Highly

IV. Would you use this approach (or a similar approach) to formulate your ethical decision-making in your career as a computer professional?

☐ 1 Not at all

☐ 2 A little

☐ 3 Somewhat

☐ 4 Very much

☐ 5 Highly

V. After completing this course, do you feel that the topic of computer ethics:

☐ 1 Should not be a topic area for Computer Science/Information Science majors.

☐ 2 Is not a relevant topic area for Computer Science/Information Science majors.

☐ 3 Is somewhat a relevant topic area for Computer Science/Information Science majors.

☐ 4 Is a very important topic area for Computer Science/Information Science majors.

☐ 5 Is a highly important topic area for Computer Science/Information Science majors.

VI. Which area of computer ethics do you feel holds the greatest amount of ethical dilemmas for the computer professional? CHOOSE ONE.

☐ 1 Privacy Issues

☐ 2 Intellectual Property Issues

☐ 3 Computer Crime Issues

☐ 4 Security Issues

☐ 5 Social Issues

VII. Rank the following exercises you felt assisted you in identifying and analyzing ethical issues. (Use 6 as the lowest ranked and 1 as the highest ranked.)

PLEASE RANK ALL.

☐ 1 Readings/homework from the textbooks

☐ 2 Lectures

☐ 3 Case Studies/Presentations

☐ 4 Research Paper/Presentation

☐ 5 Class Discussions (Guest Speakers, Round table discussions, etc.)

☐ 6 Library Visit

VIII. Choose the statement that best identifies your ability to make an ethical decision involving computer technology after taking this ethics course.

☐ 1 I cannot assess my capabilities and knowledge in making ethical decisions involving computer technology.

☐ 2 I don't feel capable and knowledgeable to make ethical decisions involving computer technology.

☐ 3 I feel somewhat capable and knowledgeable to make ethical decisions involving computer technology.

☐ 4 I feel very capable and knowledgeable to make ethical decisions involving computer technology.

☐ 5 I feel highly capable and knowledgeable to make ethical decisions involving computer technology.

IX. Which activity did you enjoy most? CHOOSE ONE.

☐ 1 Discussions

☐ 2 Working in a Group

☐ 3 Readings/Articles

☐ 4 Guest Speakers

☐ 5 Lecture Topics

X. Here is a list of courses. Please rank them in terms of your opinion as to their importance with respect to course content. Mark what course is most important to include in a computer science curriculum with a 1 and the course least important to include with a 10. Sequentially number the remaining courses in terms of their importance until all are ranked. Please give each course a unique number (no ties allowed). If you aren't sure, please guess.

☐ Artificial Intelligence

☐ Data Structures

☐ Database

☐ Distributed Computing

☐ Ethical Issues in Computing

☐ Finite Automata

☐ Graphics

☐ Operating Systems

☐ Software Engineering

☐ Testing and Reliability

XI. The section that follows contains a short scenario. As you read this scenario, imagine that you are the person in the scenario.

SCENARIO:

You work at a software development company, and your company is working on a program that will control an anti-lock braking system for a pickup truck. This software is a considerable advance over previous versions, and will make the brakes even more effective on slippery surfaces. Your main duty is to receive data from software quality control engineers and produce reports for managers about the progress of software testing. While you are producing this month's report, you think there are some discrepancies in the data reported. You discuss your misgivings with the engineer who gave you the data, and he suggests you talk to the department head. You talk to the department head, and she assures you that the data is correct, and asks you to please finish the report as soon as possible. The department head reminds you that she has an advanced degree in computer science (you do not), and that she sees nothing wrong with the data. You are still unconvinced, and worry that the data may hide flaws in the software testing results so far and could lead to consumer injuries. You are considering taking the issue to your department head's boss, who also has an advanced degree in computer science.

Please imagine that you are the person considering taking the issue to the department head's boss. As you pondered your options, a variety of reasons might occur to you that support both going to the department heads' boss and not going to the department heads' boss. Several of these are listed below. Please indicate the extent to which the reasoning in the given statement would influence your final decision.

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☐ The software will improve anti-lock brakes to make them safer.

☐ I don't want to lose my job for doing the wrong thing.

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☐ Since I don't have the experience, I need to rely on the experience and recommendations of others.

☐ I would rather avoid being blamed for any trouble that might result.

☐ If I make the right decision, I will be more likely to be promoted.

☐ It's my job to do what most benefits the organization.

☐ People involved in software testing have a responsibility to protect the public.

☐ If I make the right decision, my job performance evaluation will be very positive.

☐ I should follow whatever advice I get from the code of ethics for computer scientists.

☐ It is most important for me to follow the company's rules about who makes what decisions.

☐ We should be concerned about the safety of the people who will drive the pickup trucks.

XII. You are in charge of the National Science Foundation's new division "BCS: Better Computer Science." You get to distribute $1,000,000 (U.S.) to the following categories. Assume that there are roughly similar numbers of grant applications in each category and that these applications are of a similar quality. Your decision should be based on your judgment of the relative importance of these categories. For each category, write down the amount of money you will grant from the $1,000,000. (The numbers should sum to $1,000,000.)

AMOUNT	CATEGORY
,000	Artificial Intelligence
,000	Biometrics
,000	Commercial Off-The-Shelf Software (COTS)
,000	Database Management
,000	Ethical and Societal Issues in Information Technology
,000	Formal Methods in Computer Science
,000	Image Processing
,000	Networking
,000	Programming Languages
,000	Robotics

TOTAL SHOULD EQUAL $1,000,000

Appendix C

A FOUR-STEP ANALYSIS PROCESS WORKSHEETA FOUR-STEP ANALYSIS

PROCESS WORKSHEET

Title of Article/Issue:

STEP I. Define the Situation.

List the relevant facts. State facts in complete sentence: (List more than five facts.)
At the end of your list, cite reference from your source(s).
1.
2.
3.

What ethics/values are in question from the above facts? (List more than three facts.)
1.
2.
3.

List the stakeholders involved. List the individuals/groups who are/may be affected by this issue and how. Be specific.

WHO HOW

Step II. Isolating the major ethical dilemma.

Write several statements or questions that are ethical dilemmas from this situation.

What is the ethical dilemma to be resolved NOW? State it using the form: Should someone do or not do something? Keep this statement simple. For example: Should people buy pirated software? NOT Should people buy pirated software even though they cannot afford the price of proprietary software?

Step III. Analyzing the ethicality of both alternatives (yes or no) to your dilemma.

Consequentialism (teleology) – *Does the action minimize actual and potential harm?*
Utilitarianism: Good for the group, least harm for the group

If you answered the ethical dilemma…	Harmed-State how each stakeholder is harmed.	Not Harmed-State how each stakeholder is not harmed.	Benefited-State how each stakeholder is benefited.	Not Benefited-State how each stakeholder is not benefited.
Yes				
No				

Which alternative results in the least harm in answering the dilemma yes or no? Why? (There is no right or wrong choice. Interpret the outcome of the analysis.) For example: The answer to the question that would result in the least harm would be…. Because answering ……

Which alternative results in the maximum benefit in answering the dilemma yes or no? (There is no right or wrong choice. Interpret the outcome of the analysis.) For example: The answer to the question that would result in the maximum benefit would be…. Because answering ……

Therefore, based on the above analysis, the Utilitarian's position on this dilemma would be…..

Step III. Analyzing the ethicality of both alternatives (yes or no) to your dilemma.

Deontology –*Rights and duties*

If you answered the ethical dilemma…	Rights Violated or Abridged-State how each stakeholder's rights were violated.	Duties or Responsibilities Neglected/Not Met-State how this/these stakeholder(s) violated the other stakeholder(s) rights.
Yes		
No		

In deontology analysis, do the following in the above chart:

Identify which stakeholders' rights have been or may be violated/abridged.
Identify what duties have been or may be neglected.
Remember: *When listing a right, show its corresponding duty and vice versa.*

How would you interpret the outcome of the deontologist's position on your dilemma?

Step III. Analyzing the ethicality of both alternatives (yes or no) to your dilemma.

Kant's Categorical Imperative
The principle of consistency: What if everyone acted this way?
The principle of respect: Are people treated as ends rather than means?

If you answered the ethical dilemma…	Would anyone be treated with Disrespect?	Would anyone be treated Differently?	Would there be any Benefit to anyone?
Yes			
No			

Which alternative is preferable? What would be Kant's position to your dilemma?

Step IV. Making a decision and planning the implementation

Based on the analysis in Step III, choose which theory *best* applies to this situation. Add any arguments justifying your choice of these ethical principles to support your decision.

Kant's Categorical Imperative
Consequentialism (Teleological)
Deontological
Other: (Name the theory here)_____

Explain your choice above:

Your decision: What would you do? Why? List the specific steps needed to implement your defensible ethical decision.

What longer-term changes (i.e., political, legal, technical, societal, organizational) would help prevent your defined dilemma in the future?

Appendix D

Copies of Course Syllabi

University X
Department of Computer and Information Sciences
SPRING 2008
COSC 418.102: Ethical and Societal Concerns of Computer Scientists

Course Description:

This course is designed to help students deal with societal and ethical issues as professional computer scientists or as knowledgeable users. Ethical matters involving the delicate balance of information and technology in our society will be closely examined. Students will become more aware of ethical issues involving computer technology in applied areas as well as those arising from design and development of software. The affect of computer usage on the human condition in society will be discussed, with examples taken from several areas of application. Topics in intellectual property rights will be covered, as well as privacy issues, computer crimes, and legislation regarding computer technology. Professional activities in computing to be studies include professional and corporate standards, codes of ethics and good practice, and certification and licensing of computing personnel.

Through case studies, homework assignments, and in-class discussions, students will gain valuable skills, such as analytical, problem-solving, drawing reasonable inferences from observation, synthesizes and integrate information and ideas, holistic approach, creative expression and distinguish between fact and opinion.

Goals:

Students will be able to appreciate the needs of ethics as applied to computer technology.
Students will be able to analyze and debate ethical issues regarding computer technology in society using a structured problem solving approach.

Objectives:

The methodology used within this course will require students to:
Identify ethical issues.
Analyze ethical issues using a structured problem solving approach.
Debate their position on ethical issues.
Demonstrate their knowledge of ethics by the use of problem solving and critical thinking approaches.
Prerequisites: Two science courses or one math course and one science course.
Fulfills Gen. Ed. II.A.2 requirement

Highly Recommended: A previous computer course and an upper-level English course

Required Texts:
Ethics & Technology: Ethical Issues in an Age of Information and Communication Technology, Herman T. Tavani (author), John Wiley & Sons, Inc. (publisher)-**E&T**
Case Studies in Information Technology Ethics (2nd ed.), Richard A. Spinello (author) Prentice Hall (publisher)-**CSITE**

Recommend Readings:
The professor will distribute a separate list.

Grade Breakdown:

Case Study Projects	30%	(15% each)
Final Paper	25%	
Participation (online & in-class)	15%	
Homeworks	10%	
Online Assignments	20%	
	100%	

(For more information on how grades are calculated go to Course Information in Blackboard)

Since the University revised its grading method and grade points per credit/unit in Fall 06, the following grading chart has been revised to indicate this change:
No grades will be rounded up to the next higher number.

Grade	% - Percentage	Grade Pts.	Grade	% - Percentage	Grade Pts.
A	93-100	4.00	C+	75-79.99	2.33
A-	90-92.99	3.67	C	70-74.99	2.00
B+	87-89.99	3.33	D+	65-69.99	1.33
B	83-86.99	3.00	D	60-64.99	1.00
B-	80-82.99	2.67	F	59.99 & Below	0.00

Blackboard

Students are** required to enroll in COSC 418A located in Blackboard. ****All assignments are to be submitted through the digital drop box unless indicated by the instructor.

Expectations

This course requires extensive reading, writing and discussion/participation. During this course, students will fully utilize the extensive resources of Cook Library, other library facilities and the World Wide Web. It is expected that

students have basic knowledge in several application software skills, (such as, word processing, presentation, and spreadsheet software). Students can use the Student Computing Services Center to learn these skills. Also, it is beneficial to students to acquire an e-mail account. *All homework assignments, case studies, and final papers will be submitted through the digital drop box using Blackboard.* ***Writing is a major part of the coursework. It is expected that students have completed some level of an English composition course. If students required assistance in this area, contact the TU English (writing lab).***

Online & In-Class Discussions

The majority of class time involves discussing relative ethical issues and concerns. The discussion revolves around assessing these factors from assigned readings, homework assignments, and take home assignments. Students should participate in class fully by attending all classes and contributing to the online discussions. More information on Grading In-Class Discussion is found under "Course Information" in Blackboard (Learnonline).

Homework/Case Study/Final Paper Assignments

All *homework assignments* ***are expected to be submitted to the instructor on the posted due date.*** *NO HOMEWORK WILL BE ACCEPTED LATE.*

Online Assignments ARE DUE ON THE assigned due date listed either in syllabus or in Announcements in Blackboard. (NO ONLINE ASSIGNMENTS WILL BE ACCEPTED LATE OR GRADED.)

Case Study and Final Papers will not be accepted after the specified due date. LATE SUBMISSIONS WILL RECEIVE A GRADE OF "0".

Cheating Policy

The only collaboration that students can and should do on assignments is on the group case study assignments. ON ALL OTHER ASSIGNMENTS (i.e., homework and final paper), students are expected to submit their own work. ***Incidents of plagiarism and cheating will result in a grade of 'F' and possible dismissal from the course.*** Details for the Plagiarism Policy can be found at University X's website.

Attendance Policy

Attendance will be taken in every class session *AND online sessions****. Students are expected to attend all sessions of this course. Failure to attend classes regularly will result in reduction of points toward the final grade.*** *Students who fail to participate on the online discussions, class discussions, and in Online Assignments will receive significant points reduction to their final grade (i.e., a whole letter grade deducted.)*

U N I V E R S I T Y X
Department of Computer and Information Sciences
SPRING 2008
COSC 480.101: Senior Seminar: Ethics

Course Description: To prepare students to deal as professionals with the social and ethical issues in the computing sciences as well as to make them aware of the broad applications of computers and the implications of these applications.

Prerequisite: Senior standing in Computer Science or Computer and Information Systems. Students majoring in Computer Science must either take this course or COSC 418, but not both.

Text: Reynolds, George, *Ethics in Information Technology*

Requirements: (*This course requires extensive reading, writing and discussion/participation.)*

Students are required to enroll in COSC480A located in Blackboard. **All homework assignments, initial paper topics, progress reports, and final papers are to be submitted through the digital drop box using Blackboard.

Participation in the discussion is necessary. Class participation is very important. Participation means that each student is expected to have read the assignment prior to class and to take part in the discussion at each class session. *Each student will be assigned a class time to conduct a discussion.* More information on grading class discussions is found under "Course Information" in Blackboard.

Writing is a major part of the coursework. It is expected that students have completed some level of an English composition course. If students required assistance in this area, contact the TU English (writing lab). *All Papers will be submitted to a plagiarism software package (i.e., Turnitin). Plagiarism software scans and detects documents for plagiarism.*

***All** homework assignments **are expected to be submitted to the instructor on the posted due date. Homework assignments are due by NOON the next class period.** No assignments will be accepted after the due date and time.*

Cheating Policy: The only collaboration that students can and should do on assignments is on the group case study assignments. ON ALL OTHER ASSIGNMENTS (i.e., homework and final paper), students are expected to submit their own work. ***Incidents of plagiarism and cheating will result in a grade of 'F' and possible dismissal from the course. See Course Information in Blackboard regarding Plagiarism.***

Attendance Policy: ***Since a major part of this course is participation in classroom discussions and oral reports, regular attendance is required. Attendance will be taken in every class session. Students are expected to attend all sessions of this course.*** *Students who fail to attend the final paper presentations of fellow classmates will be penalized a letter grade.*

Failure to attend classes regularly and/or attend final paper presentation will result in reduction of points toward the final grade.

Tentative Schedule*
Spring 2008

Date	*In-Class Activity*	*Assignments*
1/30	***Introduction to the course***	***HW #1 – DUE: 2/6***
2/6	***Lecture***	***HW #2 – DUE: 2/13***
2/13	***Lecture and Class Discussions***	***HW #3 – DUE: 2/20***
2/20	***Lecture and Class Discussions***	*Initial Paper Topic* ***Complete Steps 1 & 2*** *Submit three references* ***DUE: 2/21***
2/27	***Lecture and Class Discussions***	***HW #4 – DUE: 3/5***
3/5	***Final Paper & Presentation Requirements***	***HW #5 – DUE: 3/12***
3/12	***Lecture and Class Discussions***	*Progress Report* ***Complete Steps 1 thru 4 (submit all four steps)*** *Submit full reference list for final paper (10 reference minimum)* ***DUE: 3/26***
3/26	***Class Discussion*** ***Course Evaluations***	***NONE***
4/2	***Final Paper Presentations***	***NONE***
4/9	***Final Paper Presentations***	***NONE***

Notes:

The *Initial paper topic* ***consists of Steps 1 & 2 and the*** *Progress Report* ***consists of Steps 1, 2, 3 & 4 (all steps).***
Final Papers ***are due in the digital drop box NO LATER THAN 12 noon on*** *April 10, 2008.* ***No Papers will be accepted and graded after that date and time. Any papers received and timed, in the digital drop box, after*** *12 noon* ***on the due date will receive a grade of*** *"0"*.

Class Discussions (NEW)
Every week students are to bring in current issues/events involving computing technologies and ethical issues for discussion. Students are to give a brief synopsis of the issue and prepare questions for class discussions

Grading Policy

Homework Assignments		***20%***
Class Participation/Discussions		***10%***
Final Paper		*70%*
Initial topic selection	***5%***	
Progress report	***5%***	
Finished product	***35%***	
Presentation	***20%***	
Peer evaluation	***5%***	
TOTAL		*100%*

Since the University revised its grading method and grade points per credit/unit in Fall 06, the following grading chart has been revised to indicate this change:

No grades will be rounded up to the next higher number.

Grade	**% - Percentage**	**Grade Pts.**	**Grade**	**% - Percentage**	**Grade Pts.**
A	93-100	4.00	C+	75-79.99	2.33
A-	90-92.99	3.67	C	70-74.99	2.00
B+	87-89.99	3.33	D+	65-69.99	1.33
B	83-86.99	3.00	D	60-64.99	1.00
B-	80-82.99	2.67	F	59.99 & Below	0.00

Appendix E

Copy of Grading Rubric
Instructions for Case Study Assignments
Guidelines for Research Paper

Written Communication	Inadequate (1 pt.)	Needs Improvement (2 pts.)	Adequate (3 pts.)	Excellent (4 pts.)
Clarity (Whole Essay)	There appears to be no organization of the essay's contents.	Organization of the essay is difficult to follow due to a combination of the following: Inadequate transitions Rambling format	The essay can easily be followed. A combination of the following is apparent: Basic transitions are used. A structured format is used.	The essay can easily be followed. A combination of the following is apparent: Effective transitions are used. A polished format is used.
Mechanical (Sentences)	Sentences and paragraphs are difficult to read and understand due to poor grammar or mechanics	The essay contains numerous grammatical and mechanical errors.	The essay contains minimal grammatical or mechanical errors.	The essay is clear and concise and contains no grammatical or mechanical errors.
Organization (Paragraphs and Bibliography Page)	Unclear and vague paragraph distinctions/Citations on bibliography page are not consisted with topic area.	Thoughts or issues expressed in the paragraph breakdown need more modification. Not enough citations were used (or noted) on the bibliography page.	Paragraph organization was good. The bibliography page was constructed in an orderly and correct style.	Eloquent paragraph organization/Excellent references used in the bibliography page

Content	Inadequate (2 pts.)	Needs Improvement (4 pts.)	Adequate (6 pts.)	Excellent (8 pts.)
Followed the Assignment Directions	The paper has no apparent relation to the directions of the assignments.	Some of the paper follows the directions.	Most of the paper follows the directions.	The paper follows the directions precisely. (i.e. the sections are labeled, directions for finding the article are clear, all required information, etc.)
Explains the technical issue	Names the technical issue.	Attempts to explain the technical issue.	Technical details are accurate.	Is both concise and complete in technical explanation
Stakeholders are Identified and what values are at stake.	Does not identify who is impacted by the ethical dilemma or how they are impacted. Does not explain the values are stake.	Specifies either who is impacted by the ethical dilemma OR how they are impacted, but not both. Attempts to explain the values at stakes.	Specifies who is impacted by the ethical dilemma AND how they are impacted. Attempts to explain the values at stakes.	Specifies who is impacted by the ethical dilemma AND how they are impacted. Clearly explains the values at stake.
Used the four steps in the Analysis process	None of the steps used in the analysis process	The paper included some of the steps for an ethical analysis of the case.	The paper included all of the four steps to support a **reasonable** ethical analysis of the case.	The paper included all of the four steps to support a **strong** ethical analysis of the case.
Conclusion: Justified preferred position	Didn't pick a position	Picked, but didn't justify (with or without the four step analysis process)	Picked and tried to justify (using the four step analysis process) weak	Convinced me—Essay provides a persuasive argument that clearly supports the position.
Cited references (whole paper)	The paper has no apparent citations.	The paper included minimum # of citations..	Several citations were used throughout the paper	The paper included an appropriate # of cited references..

Instructions for Case Study Assignments

Case Study #1 Assignment
Note: The subjects of these articles are on Intellectual Property issues.

To find the link to an article, click on the attached document.

1. Pick two articles for ethical analysis.

2. You will complete a separate Four-Step Analysis Form for each article.

3. Turn in both Four-Step Analysis forms by NOON (or 11:59 a.m.) on date.

Case Study #2 Assignment
Note: The subjects of these articles are on privacy, security and computer crimes.

To find the link to your case/issue, click on the attached document.

1. Choose two articles from the attached document.

2. The Professor will finalize your choices. (YOU WILL NOT HAVE THE SAME NUMBER AS IN CASE STUDY #1.)

2. You will complete a Four-Step Analysis form of each article.

3. Turn in both Four-Step Analysis forms by NOON (or 11:59 a.m.) on date.

Guidelines for Research Paper

Criteria for the Research Paper

- Use all four steps in the Four-Step Analysis Process for Ethical Analysis and Decision Making. You may disagree with a particular step in the analysis process; however, you must substantiate your opinion with credible references. **(Use citations in your explanation.)**
- State which stakeholder you identify with and how does this affect your view(s).
- State your solution. (In identifying the ethical issues in the case, you must state the opinion you support as well as other views addressed in the case.)

Paper Format

Paper must be 10 or more -typed pages, double-spaced, and use 12 point font. (Use A.P.A. or M.L.A. guidelines for typing your paper.) **Title page, Reference page and Table of Contents are not counted towards the 10 or more pages.**

1. **Include a Bibliography page, which contains citations/references from the following areas:**
   a. Books (if applicable)
   b. Journal articles
   c. Web/internet references
   The paper must contain a minimum of 10 total references.

2. The paper must be submitted in a **cohesive** and **organized** fashion. **The paper will be graded by the criteria of the rubrics.**

   a. Title page – which includes the topic covered, name and date.
   b. Sub topics covered in the paper must be typed in bold and centered.
   c. Page Numbers – at the bottom centered or right-hand side of page
   d. Any graphs, charts, or other supportive information can be included and noted in the paper. **Don't forget to use citations when including this information.**
   e. Bibliography Page, which includes the information in number two.

All Papers are due in Blackboard: May 16, 2008 (BY 11:59 p.m.)

PAPERS SUBMITTED LATE WILL NOT BE GRADED. STUDENT WILL RECEIVE A ZERO. PAPERS WILL BE SUBMITTED THROUGH PLAGIARISM SOFTWARE. LACK OF CITATIONS WILL RESULT IN A ZERO FOR THE PAPER!!!

APPENDIX F

Copy of IRB Approval Letters
Copy of Letter to Students
Copy of Student Consent Form

April 3, 2007

To: Alfreda Dudley-Sponaugle
Kazumi Hasegawa

From: The Human and Animal Research Protections Office (HARPO)

Re: Exemption Certificate
Protocol # : **Y07AD27148**

The Institutional Review Board has reviewed your protocol entitled **Assessing Students' Perceptions of Ethics instruction in a computer Curriculum** and has approved the application for certification as it met the criteria under **[exemption (§46.101(b)(2)]** for exemption from further IRB review.

Annual review is not required for this protocol since it was determined to be exempt. However, any changes to the research design or procedures that could introduce new or increased risks to human subjects must be submitted ***in writing*** for review by the IRB before the changes are incorporated to insure they do not change the exempt status of the protocol. All correspondence and materials used in this protocol must reference the above IRB number.

Please refer to the IRB Researcher's Guide, found in your department or via the Institutional Review Board web site (www.umbc.edu/irb), for additional information about the administration of your protocol.

If you have any questions, please contact HARPO via the above phone number or e-mail.

Cc: Timothy Sparklin

Exempt review approved by:

Susan Sonnenschein, Ph.D.
IRB Chair

Dear Student:

As part of my research on computer ethics, I will be conducting a pre and post evaluation to assess students' perceptions of the computer ethics courses taught at University X. In participating in this study, you will be asked to do two surveys. The first survey will be distributed at the beginning of the semester. The second survey (post-evaluation) will be distributed at the end of the semester. It is appreciated if all questions on this survey were completed.

You will be asked to give some personal information on the surveys. The information is used to assess your individual pre and post evaluations for research purposes. In participating in the pre and post evaluations, your information will be completely confidential. No one outside of the researcher will be able to identify you. Your information will be kept in a secured location. You will not be graded on your answers on the surveys. Your final grade will not be affected by participating in the pre and post evaluation surveys.

If you have any questions about this project, you may contact me at 410-704-2104 or the Chairperson of University X's Institutional Review Board for the Protection of Human Participants, Dr. Patricia Alt, at 410-704-2236. Thank you for your time,

Sincerely,
Alfreda Dudley-Sponaugle
Professor and Principle Investigator

I, _____, agree to participate in the study detailed above. The above-named investigator has answered my questions and I agree to be a research subject in this study. I have been informed of the risks and benefits of my participation in the project, and that my participation in this study is completely voluntary. I am free to withdraw my consent for participation in the study at any time. The researcher, Alfreda Dudley-Sponaugle, responsible for this research has offered to answer any and all questions regarding my participation in this study. If I have any further questions I can contact the UMBC Institutional Research Board.

Print Participant's Name: _____ Date: _____

Participant's Signature: _____ Date: _____

Researcher's Signature: _____ Date: _____

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