PROJECT DEMONSTRATING EXCELLENCE

Integrating Ethics into the Computer Science Curriculum, Focusing on the Database Course

by

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When the Glasgow family settled in America during the colonial period and started their migration west into Tennessee and Kentucky, they brought with them their family, an ax, a rifle, the Bible, and other books. I am tremendously grateful to those Glasgows who came before me for the gift they have handed down through the generations - that Scottish respect for learning that has played such an important role in making this dissertation possible. I am certain that my parents, Jake Harbine Glasgow and Dorothy Maxine Glasgow, would have been extremely proud to see this dissertation.

Most importantly, I want to thank my wife Doreen and sons James William Glasgow and Scott Michael Glasgow for their support.

Biographical Sketch

James F. Glasgow, a native of western Kentucky, has twenty-one years of industry experience in information technology (1977–1998) and has served since 1998 as an assistant professor of computer science at Malone College in Canton, Ohio. Jim holds an M.S. in technical education from the University of Akron and an L.S.M. in computer science and philosophy from Kent State University. He completed his doctoral work in computer science at Kent State before beginning his interdisciplinary work in computer ethics at the Union Institute and University in Cincinnati.

Jim has been a member of the Association of Information Technology Professionals since 1983 and the Association for Computing Machinery since 1985. In 2004, the governor of Kentucky commissioned Jim as a Kentucky Colonel, the highest honor awarded by the Commonwealth of Kentucky, for his dedication to higher education.

Jim and his wife Doreen reside in Green, Ohio and have two sons, James William Glasgow and Scott Michael Glasgow.

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ABSTRACT

Keywords: Database Ethics, Computer Ethics, Computer Science Ethics, Information System Ethics, Natural Law, Virtue Ethics, Information Management

The purpose of this dissertation is to provide a baseline study to increase awareness and provide direction for the future development of a comprehensive model curriculum for the integration of ethics into the database course. In this dissertation, the researcher analyzed and interpreted the results of a study of computer science professors at smaller colleges primarily from the Christian College Consortium (CCC) organization. The administration from the thirteen CCC member colleges support Christian higher education in the liberal arts tradition through the sharing of resources, programs, and ideas. The survey was generated from an exhaustive review of the computer ethics literature along with an examination of both professional codes of ethics and the researcher's professional experiences. The survey questionnaire included questions concerning each module of the database course as identified by ACM/IEEE 2001 model curriculum. The data analysis did not support the null hypothesis that professors effectively integrate ethics in their database course and meet other course objectives. This research suggests that additional work is needed in the area of providing an effective level of ethical integration in the computer science database course. The researcher provides selected case studies to assist computer science professors in the integration of ethics into their database course. The author summarizes several major ethical theories in the appendices.

Chapter 1: Introduction

In recent years, it has become increasingly evident that undergraduate computer science courses are not helping students to achieve an effective level of awareness about ethical and social issues. The researcher has concluded from professional observations and the literature that professors are primarily concerned with the technical aspects of each of the computer science courses and that many ignore the ethical component that is being recommended by the computing community. This dissertation focuses on the integration of ethics into the database course that represents an important component of the undergraduate computer science course of study. A survey is utilized to gather data for the generation of recommendations for computer science professors concerning the effective integration of ethics into the database course. This chapter discusses the overall scope of this dissertation and provides an overview of the research conducted. Specifically, it provides a statement of the problem, describes the rationale for the research, and presents the thesis statement. Additionally, it will introduce the research model and the hypothesis, and provide a glossary of technical terms. Finally, this introductory chapter will conclude with an overview of the remaining chapters of this dissertation.

Statement of the Problem

At present, there are few guidelines for the effective integration of ethical issues into the technical courses that form the undergraduate computer science curriculum. Consequently, computer science professors have found it difficult to provide effective coverage of both ethical and technical issues in computer science courses. Indeed, there is currently a lack of consensus concerning the ethical content in each of the technical

computer science courses that are required to meet the standards for the Accreditation Board for Engineering and Technology (ABET), for the Institute of Electrical and Electronics Engineers (IEEE), and for the ACM Computing Curricula 2001 document. While the need for integration has been identified by researchers (Martin, 1999; Buerck, 2001; Prior, Rogerson, and Fairweather, 2002), too few topics have been suggested to adequately cover the ethics component in technical computer science courses.

The database concepts course has been a key component of the undergraduate curriculum since relational database theory emerged in computer science in the early seventies. Codd (1970) described relational database concepts and developed techniques that continue to have an ethical dimension. Relational database techniques help designers increase data accuracy and integrity. With the globalization in computer networks, the importance of databases has intensified, especially the ethical dimensions surrounding the technology. Therefore, the database course (also referred to as the information management course) represents the focal point for many of the ethical issues that emerge from computer science. In the next section, the researcher discusses the rationale for this dissertation and identifies the need for this research.

Rationale

In recent years, computer ethics literature has begun to focus increasingly on the need for an effective level of integration of ethics across the computer science undergraduate curriculum, for instance (Martin, 1997a; Prior et al., 2002). Such studies have suggested to the researcher that although some ethical topics are included for discussion in course material, for the most part, professors choose their own topics and their teaching approaches independently.

The database course has been selected as a focal point of this research because the technical material from this area lies at the center of many of the ethical debates that are occurring in computer science. This research has two main goals. The first goal is to provide a supportive argument for doing a more effective job integrating ethics into the database course. This supportive argument will be derived from an examination of the consequences that emerge from unethical database practices. The second goal is to provide instructors with guidance regarding what ethical topics to include in the database course. This guidance will include discussions involving how database content that appears to be exclusively within a technical context has ethical dimensions. The integration of ethics will enrich the database course within the undergraduate computer science curriculum with ethical issues that are framed and interpreted within a solid theory of ethics. The next section provides a thesis statement for the dissertation and generates a foundation for the description of the overall research model that follows.

Thesis statement

> A survey of computer science professors from the Christian College Consortium and similar colleges is used to determine current levels of ethical integration and importance levels involving specific ethical issues that relate to database content. The data analysis and descriptions of various ethical theories in the appendix will support the overall purpose of the research to increase professor awareness and provide direction, through the examination of ethical issues and sample case studies, for the future development of a comprehensive curriculum model for the effective integration of ethics into the database course. While individuals have their own opinions, a natural law theory of ethics can serve as a long established

tradition as a major theory in moral and ethical thought even for those who seek right and good actions within the database area of computer science.

The Research Model

Towards the objective of effectively integrating ethics into the database course, data from four sources were examined: (1) a review of the literature, (2) the Association for Computing Machinery (ACM) professional code of ethics, (3) the Association of Information Technology Professionals (AITP) professional code of ethics, and (4) the researcher's professional experience. Information gathered from these sources was utilized to design a questionnaire for collecting data from teachers of computer science courses. The following illustration provides a summary of the overall thesis statement:

Figure 1.1

Dissertation Research Model

Review of the literature

Association for Computing Machinery code of ethics

Association of Information Technology Professionals code of ethics

Researcher's personal industry and teaching experience

=======→

Computer science professor survey

==========→ Increased awareness and direction for the effective integration of ethics into the computer science database course

The review of the literature, the first source consulted during the design of the survey, provided information about the ethical issues that have been identified within the database course of the computer science program. Some ethical issues from the literature review were found within the context of database technology, for instance *privacy* and *integrity*; however, many ethical issues were not found within this context and only became evident as connections between ethical issues and the database content emerged, for instance issues such as *the utilization of record locking to enforce mutual exclusion* and *information* preservation. Information was also gathered from the Computing Curricula 2001, which is the result of a joint effort between the IEEE Computer Society and the Association for Computing Machinery. The Computing Curricula 2001 indicates that there is a lack of research into ethical issues related to the creation and structure of effective databases. The Computing Curricula 2001 document also suggests that instructors discuss ethical issues during the database course introduction and during the lecture involving digital libraries. However, it does not list any ethical issues for the majority of the database course sections.

The second and third sources consulted during the survey design were the well established ACM and AITP professional codes of ethics. Many of the issues found in these codes of ethics pertain to the computer science database course, for instance *giving proper credit for intellectual property* and *maintaining the confidentiality of information*. A copy of the Association of Computing Machinery code of ethics is provided in Appendix D and a copy of the Association of Information Technology Professionals code of ethics appears in Appendix E of this dissertation.

As a fourth source, the researcher consulted his own personal experiences, specifically 21 years of industry experience with database technology and 6 years of teaching database concepts at the college level. These experiences provided input to the survey instrument, for example, regarding the ethical issues associated with database design.

The information from these four sources was used to construct the questionnaire for this study, which was administrated to computer science professors, primarily from the Christian College Consortium (CCC). The objective of this study was to investigate how computer science professors handle the ethical component in their technical courses. The resulting data was used to develop recommendations for the selection of ethical content that could be integrated into the database course.

These recommendations are supported by a character-based theory of ethics that is founded on a set of universal laws within the context of natural law. Parker (1968) and Moor (1985) found that moral problems emerge from the unethical use of computing technology. Artz (1994) and Johnson (1985/2001) reported that moral problems can be solved most effectively by basing moral decisions concerning computer technology on a solid character-based theory of ethics grounded in a strong foothold found within a set of universal ethical laws.

The results of the computing science professor study will help to provide answers to important questions concerning how to effectively integrate the ethics component in the undergraduate computer science database course. The resulting recommendations, which are based on a solid character-based ethical theory, have a direct relationship to the

technical content as prescribed by the IEEE/ACM Computing Curricula 2001 set of standards for the information management (IM) area.

The IEEE/ACM Computing Curricula 2001 document provides a significant model for computer science instruction. This document contains a list of topics and learning objectives for each sub-area within information management. However, although this document does recommend the integration of ethics in broad areas, it provides few if any specific recommendations concerning ethics within the domain of database design and development. Thus, the recommendations developed by this researcher supplement the set of curricula standards in the IEEE/ACM Computing Curricula 2001, and in so doing, these recommendations provide a more complete linkage among the technical topics, related moral issues, and a solid character-based ethical theory. Many computer science professors base their instruction on these curricula standards; therefore, supplementing these Computing Curricula 2001 standards with the recommendations developed in this dissertation research will result in a wider application of the recommendations proposed by this researcher.

Primary Research Question

This dissertation research examines several research questions. The full set of research questions are provided in Chapter 3 of this dissertation. As discussed earlier, this researcher's observation suggests that many professors ignore the ethics component of computer science courses. The primary research question is as follows:

> **Do computer science professors from the population, in preparing students for entry into the information technology profession, effectively integrate ethical issues into the undergraduate computer science database course?**

Hypothesis

The hypothesis that forms the basis for this research is that the computer science professors in the sample do not effectively integrate ethics into the computer science database course. Another way to state this hypothesis is

Ethics cannot be effectively integrated into a database course and still meet the course objectives.

A counter position could be stated as

There exist no differences between the computer science professor survey results and the expectations of the external organizations (ACM and AITP) concerning the effective integration of ethics in the computer science database course.

Another way to state this counter position is

Professors of computer science courses can effectively integrate ethics into a database course and still meet other course objectives.

Definition of Technical Terms

This section provides definitions for key technical terms in this dissertation. The definitions are based on Kroenke (1992/2002) and the researcher's own understanding of the concepts.

Backup Policy

The procedures associated with saving information on tape or some other device for off-site storage. Part of a comprehensive disaster recovery plan. Information on backup devices can be restored back to the live system.

Committing a Transaction

A command issued to the database management system (DBMS) to make database modifications permanent.

Data Definition Language (DDL)

A language used to describe the structure of a database.

Data Duplication

The same data stored in multiple locations in a file-processing or database system. Data duplication decreases the integrity of the database.

Data Independence

Data Independence results from defining files and database tables outside the scope of individual computer programs.

Data Manipulation Language (DML)

A language used to describe the processing of a database.

Data Mining

The search and analysis of historical information stored in modern database systems.

Data Modeling

A language or technique used for describing the structure and processing of a database.

Database Administrator

The management function that is concerned with the effective use and control of an organization's data assets. Specific functions include setting data standards and policies.

Database Management System (DBMS)

A set of programs used to define, administer, and process the database and its applications.

Depersonalizing

The removal of personal information prior to sending data to exterior organizations.

Digital Libraries

Digital libraries are large database applications that contain books, journals, and other library materials. These systems provide effective search mechanisms.

Distributed Database

A database stored on two or more computers.

Entity-Relationship Diagram

A graphic used to represent entities and their relationships.

File-Processing System

Systems that predate database technology. Individual files that are described, opened, processed, and closed in computer programs without the use of a database management system.

Flat-File

A file that has only a single value in each field. The meaning of the columns is the same in every row.

Information Presentation

How information is displayed or printed on output devices. The use of text along with graphical user interface (GUI) technology.

Information Preservation

The preservation of data and information for future generations.

Invisibility factor

Pertains to the hidden aspects associated with the internal logic of computer programs.

Mutual Exclusion

The locking of data records when updating to prevent loss of information.

Normal Form

A rule or set of rules governing the allowed structure of relations. The most important normal forms are 1NF, 2NF, 3NF, BoyceCodd NF, 4NF, 5NF, and Domain/Key normal form.

Normalization

The process of evaluating a relation to determine whether it is in a special normal form and, if necessary, of converting it to relations in that specified normal form.

Phishing

The process of sending email to a user falsely claiming to be a legitimate organization with a sole objective of obtaining personal and private information.

Query Language

A language for defining the structure and processing of a relational database. A query language can retrieve information from a database and in many cases update both the database structure and internal data.

RAID

Redundant Array of Inexpensive Disks. Used to increase database speed and for recovery from disk failure. With RAID, data is not lost when one or more disk drives fail.

Relational Model

A data model in which data is stored in relations and relationships between rows are represented by data values.

Relational Schema

A set of relations with interrelation constraints.

Semantic-Object Diagram

The constructs and conventions used to create a model of the user's data. Relationships are modeled in objects and the results are usually documented in object diagrams.

Scalability

The ability to grow as the database needs increase.

Traditional File System

Same as File-Processing System (defined above)

Update Statements

Query or program statements that add, change, or delete to data stored in the database environment.

Research Overview

This chapter has provided an overview of this dissertation research, which focuses on the integration of ethics into a computer science database course. The statement of the

problem was discussed, along with the rationale, the thesis statement, the dissertation research model, the primary research question, and the definition of technical terms.

Following this introduction, Chapter 2 focuses on the literature review, which examines the emergence of computer ethics, the integration of ethics into computer science education, and various database-related ethical issues. Chapter 3 presents an overview of the dissertation research, lists the complete set of research questions, and describes the researcher's hypothesis. Additionally, Chapter 3 describes the survey population, the structure of the assessment instrument, and the pre-survey communications, and it discusses the institutional review board (IRB) consent paperwork that was required for this dissertation. Chapter 4 presents the computer science professor survey results. Here, in addition to demographics, the researcher presents data concerning the detailed computer ethics-related questions. Chapter 5 contains a detailed discussion concerning the dissertation results and curricula recommendations. Chapter 6 presents sample case studies to help students make right choices as they encounter database-related ethical problems.

Chapter 2: Literature Review

Introduction

The primary goal of this literature review is to identify the ethical issues that have an impact on the database area of computer science. These ethical issues provide input for the development of the questionnaire used in this dissertation research and they will also appear in chapters 5 and 6 as part of the development of a set of recommendations for the effective integration of ethics into the database course. The discussion of the emergence of computer ethics is followed by an examination of the status quo for the integration of ethics into computer science courses. The dissertation then focuses on the primary issues that affect the database area of computer science and examines, in particular, the broad issues of *integrity*, *privacy*, *property rights*, and *responsibility* in light of the material discussed in the database course. This chapter concludes with an overview of how this dissertation helps to fill the intellectual gap in the current literature concerning the integration of ethics into the database course.

The Emergence of Computer Ethics

This section provides an overview of the emergence of computer ethics from the dawn of the computer age to the beginning of the twenty-first century. The discussion focuses on pioneering work in computer ethics and the emergence of professional codes of ethics in the computing field. Additionally, the researcher examines how discussions concerning various ethical theories have played an important role during the emergence of computer ethics.

While the roots of computer ethics as a discipline originated during the dawn of computer science, discussions continue concerning the fundamental nature of computer

ethics and how the discipline can provide the greatest benefit for human kind. Computer science has made an enormous impact on society, an impact involving government, business, science, the military, and our personal lives. Although ethics has played a significant role for human kind since the dawn of civilization (and even before), the analysis of actions within the realm of computer technology has become increasingly critical with the continuous and rapid advancement of computer science.

During World War II, Vannevar Bush (1945) of MIT described a device that resembles the modern World Wide Web. Bush suggested, "Books of all sorts, pictures, current periodicals, newspapers, are thus obtained and dropped into place. Business correspondence takes the same path" (pp. 106-107). Although Bush did not discuss the ethical dimensions, he did provide insights at an early period into what would eventually become the reality of both the Internet and multimedia database technology. The notion of information storage and direct access was a key feature in Bush's predictions for the future of information technology. Advances in database technology have contributed significantly to the recent realization of Bush's vision.

The field of computer ethics began with Norbert Wiener's 1950 book, *The Human Use of Human Beings* (Wiener, 1950/1954). Many of the issues examined by Wiener, for instance professional responsibility, are more prevalent in today's Internet society than they were during the dawn of the computer age. Bynum (2001) discussed the contribution that Wiener made to computer ethics, and concerning the foundation of computer ethics, Bynum (2000) described how Wiener's book has provided a powerful basis for "Cybernetics" (p. 6). Essentially, Wiener helped to establish computer ethics as a field of scholarly research. Wiener referred to the computer revolution as being "in the

presence of another social potentiality of unheard-of importance for good and evil" (cited in Bynum, 2000, p. 6). His prediction of "unheard-of importance" would certainly come true when the World Wide Web emerged out of the Internet during the mid 1990s. Bynum mentioned that Wiener had laid down a solid foundation for computer ethics research involving the purpose of human life, justice, methodology, the fundamental questions of computer ethics, and topics for the discipline. Wiener specified three questions for the computer ethics field (cited in Bynum, 2000, p. 11):

- What are the social and ethical implications of creating and using information and communications technology (ICT)?
- How can we ethically integrate ICT into society?
- What are the specific social and ethical responsibilities of ICT professionals?

These questions relate to the identification of ethical issues, effective awareness, and professional responsibility. This dissertation helps to provide answers to these questions from within the boundaries of the database area of computer science. Bynum (2000) reminded the reader that Wiener's view was that computers were "destined to transfer the messages and communications that constitute the 'cement' that maintains and shapes human society" (p. 10). With the advent of the Internet, World Wide Web, and email, the computer has become a "communications" machine. This is in sharp contrast to the "computational" image that computing machines had in the past. Society will continue to be shaped by the technological "cement" that computer science has provided human kind. According to Bynum (2000), Wiener insisted that the monumental challenge for humanity was ethically integrating information and communications technology (ICT) into society.

By the 1960s, computing technology was being used extensively in both business and scientific environments. By the end of the decade, computer scientists recognized the need for a professional code of ethics for the computing community. Donn Parker was one of the early founders of computer ethics because of his work with the original code of ethics for the Association for Computing Machinery (ACM), founded in 1947. Parker observed unethical behavior during the early years of computer science. Parker suggested, "When people entered the computer center, they left their ethics at the door" (cited in Bynum, 2001, p. 110). This statement supports the theory that computer-related unethical behavior, for instance, the dichotomy that exists today involving ethical attitudes regarding physical and virtual property, may have originated during the early years of the computer revolution. In 1968, Parker recognized the need for a professional code of ethics for the computing community. In the paper, "Rules of Ethics in Information Processing," he addressed the issues of professionalism with an emphasis on the establishment of a more concrete code of ethics for the oldest association in computing (Parker, 1968).

By the end of the second decade of the computer revolution, computer professionals were already observing various unethical actions in conjunction with electronic computers. This empirical evidence provided the primary motivation for the development of a professional code of ethics for the computer science community. In 1974, the Association for Computing Machinery president stated that, "The gap between the existence of a code and any real improvements in ethical conduct is very large" and suggested that education, good examples set by senior practitioners, and a society that places high values on ethical behavior are the best ways to achieve high ethical standards

(Ralston, 1974, p.2). This suggests that early pioneers in computer ethics were not only aware of unethical behavior in the computing community, but also were aware that education and example could help solve the problems arising within the realm of computer ethics. Indeed, with this reference to education, it is evident that as early as 1974, computer professionals were considering the integration of ethics into the computer science field as a partial solution to the problematic situation society was beginning to encounter.

The ACM code of ethics (found in Appendix D) represents an accumulation of years of work and provides a normative set of standards for the computer science profession. The society's code of ethics addresses many of the important issues that confront computer scientists. The ACM code of ethics begins with general moral imperatives that address such issues as avoiding harm to others, being honest, giving proper credit for intellectual property, and respecting privacy. Issues that are more specific are found in the professional responsibility section including giving thorough evaluation of system impacts and possible risks. Another section concerns the development of policies that protect human dignity. White's (1995) findings suggested, "The people who are teaching the professionals of tomorrow are not aware of the professional ethical standards accepted by experts in the field" (p. 1). This research supports the notion that the professional codes of ethics need to be more visible in the computing community. Computer science professors must have some level of understanding of computer ethics before the effective integration of ethics can occur. Most computer science professors emerged out of mathematics and engineering. While they are very proficient with the technical aspects of the computer science field, it is the

observation of this researcher that many of these professors have had little or no exposure to ethical theories and moral analysis.

With roots back to 1951, the Association of Information Technology Professionals (AITP) is one of the oldest professional organizations in the computing field. The AITP (formally Data Processing Management Association "DPMA") code of ethics (found in Appendix E) provides a set of ethical principles for the information technology community. In contrast to the scientific audience of the ACM, the AITP code pertains more to practitioners in the business community. The AITP code of ethics focuses primarily on the obligations of computer professionals to management, fellow AITP members, and society. The standards of conduct section discusses the issues of responsibility, information misrepresentation, honesty, property rights, and privacy.

In the classic paper, "What is Computer Ethics?" Moor (1985) referred to computer ethics as a field between science and ethics. He believed that computer ethics was an interdisciplinary field based on the unique application of ethics within the technical realm of computer science. Moor (1985) paved the way for the modern period of computer ethics by preparing a formal definition for the discipline: "Computer Ethics is the analysis of the nature and social impact of computer technology and the corresponding formulation and justification of policies for the ethical use of such technology" (p. 23). Moor stressed that there is a "policy vacuum" in the computing field and that new policies are needed to guide the actions of computer science practitioners. Moor's paper represented a landmark publication in the computer ethics field and triggered a higher level of research in the discipline.

While there is a high level of awareness of many of the ethical implications of using computer technology, human kind has not yet fully begun to comprehend the exact extent of the ethical dimension of computer science within our society. Many of the specific ethical implications that result in harm emerge from unreliable software, incorrect data, phishing, identify theft, a distorted perception of online property, and a lack of proactive measures to protect humanity's vast information asset. The broad categories of integrity, privacy, property rights, and responsibility encapsulate the moral/ethical implications in an effective manner. It is the observation of this researcher that our current professional codes of ethics are not as visible as they should be and not taken seriously enough by the technical people who are shaping the future of the computer science field.

According to Martin (1997b), Walter Maner of Bowling Green University in Ohio is credited with coining the term, "computer ethics" in 1976. Maner observed that old ethical problems tended to occur on a larger scale when the computer was involved. He mentioned that when computers are involved in moral problems, the problem becomes exacerbated and new ones emerge (cited in Martin, 1997b, p. 8). Thus, although the computer ethics field emerged around 1950, the actual name of the new discipline did not come into usage until a quarter of a century later.

The debate concerning the philosophical justification of computer ethics extends not only to the unique characteristics of computer ethics, but also to the supporting foundation. When one discusses the notion that new moral problems can emerge when computers are involved, the underlying universal ethical principles are not affected by the possible unique moral situations. In support of a character-based foundation for computer ethics, Artz (1994) suggested that with the computer, "It is often difficult to

determine the linkage between action and consequences" (p. 18). It becomes difficult to analyze the ethical nature of computer-related behavior from a utilitarian perspective when the consequences of such action are not clear. In the promotion of a character-based foundation for computer ethics, Laudon (1995) stated that, "Ethical action comes from the decisions of individuals based on personal conviction" (p. 39). Laudon provided additional evidence for an ethical vacuum in the new phenomenon called cyberspace (p. 33). He continued to say that in contrast to business ethics, medical ethics, and legal ethics, no systematic literature has emerged for computer ethics. He described four problematic issues relating to computer ethics literature including not being well grounded in the classical and contemporary theories, not being responsive to pressing social problems, being highly individual orientated and not being normative nor prescriptive. Laudon insisted that an understanding of how information technology affects human choice, action, and potential is a prerequisite to the ethics of information systems. Laudon (1995) stated in a very symbolic way, "We have no map of the IT ethics domain that identifies major land masses, compass directions, levels of analysis, or recommended pathways" (p. 33). Additionally, Laudon pointed out that scholars typically follow a utilitarian approach in the area of computer ethics by saying such things as, "When faced with an ethical decision, the individual should consult some larger collective – the person's firm or professional society – for advice and should follow that advice" (p. 36). This standpoint places a utilitarian impetus on the professional codes of ethics that exist in the computer science profession.

Both Artz (1994) and Laudon (1995) support the notion that with a firm foundation in the universal laws of ethics from the realm of natural law, computer ethics

becomes well grounded in a set of lasting values and virtues. Further support of character-based ethics in computer science comes from Rogerson (1995) who pointed out that, "If a more self-reflective and self-critical attitude on moral issues were adopted by considerable numbers of future IS analysts, the cumulative effect would be a significant and positive societal change" (p. 5).

This section provided a summary of how computer ethics emerged from the academic landscape during a time of rapid advancement in computer science. It is interesting that papers concerning computer ethics appeared during the dawn of computer science and have continued to appear along with the technical discussions. As computer ethics began to mature as a discipline, several researchers recognized the need for a more effective level of integration of ethics into computer science courses. However, while the recommendations for integration increased, the details of such integration remained very sparse. From early file-processing systems that did not utilize the support of data management software to modern database management systems (DBMS), information storage, protection, and retrieval has remained a centerpiece in the overall growth of the computer industry. This area of database technology provides the context for the examination of ethical issues within this literature review. The next section provides a summary of the computer ethics literature concerning the integration of ethics into the computer science curriculum that includes the database course.

The Integration of Ethics into Computer Science Education

This section will examine the specific literature concerning the integration of ethics into the computer science curriculum. The integration of ethics into the computer science curriculum became more prevalent during the last decade of the twentieth

century. Leibowitz (1990) focused on changes in the ethical sensitivity of computer science college students with the primary variable being a course in Computers and Society. A statistically significant difference in the level of ethical sensitivity was found between the group that had taken the Computers and Society course and those students who had not taken the course. Leibowitz underscored the notion that topics in computer ethics need to be included in computer science courses of study.

In an agreement with Leibowitz (1990), Orwant (1991) reinforced the notion that computer ethics is part of computer science. Pulliam (1992) focused on the perceptions of Kentucky educators concerning computer ethics and found that ethics should be taught in a module within an elective course at the freshman level. Additionally, Pulliam suggested that faculty should be expected to discuss computer ethics in other courses. Both Leibowitz (1990) and Orwant (1991) supported the notion that the integration of ethics should begin during the first year of the undergraduate experience.

In "Integrating Ethical Topics in a Traditional Computer Science Course," Winrich (1994) proposed the inclusion of ethics-related writing assignments in the technical courses. Referring to the ethical issues of computer science, White and Pooch (1994) suggested "additional instruction should not simply take the form of a single course on computer ethics, but rather should be incorporated as an integral aspect of all courses" (p. 172). In the ACM curriculum '91, guidelines Scott, Kallman, and Lelewer (1994) included eight areas of ethics that were to be interwoven throughout the entire curriculum. The work of Scott et al. illustrates that by 1994, the professional associations were beginning to recognize the importance of including ethics in the overall mix of computer science instruction. Huff and Martin (1995) recommended that the teaching of

computer ethics be extended beyond the classroom into the laboratory setting. This involves having ethical content associated with programming assignments.

Roelants (1996) addressed the need for integration in a paper concerning the relationship between ethics and the computer science curriculum. He stated, "While it is clear that a separate course on the social implications of technology is necessary, it is not sufficient. Ethical content is necessary in areas such as database and systems analysis courses" (p. 5). Gotterbam and Riser (1997) provided various goals and issues for the development of ethics-related activities in computer science courses. During 1997, there was a marked increase in the number of studies pertaining to the integration of ethics into the computer science coursework. Building upon Winrich (1994), Schulze and Grodzinsky (1997) suggested program assignments and topics for the inclusion of ethical and social issues in the first two required courses in the computer science curriculum. This research is in agreement with Pullman (1992) who also suggests integrating ethics at the freshman level.

The level of research concerning the integration of ethics into the computer science curriculum increased during the year 1997. One of the objectives for a study of ethical decisions on the online academic network was "to recommend strategies for integrating concepts of ethical decision making into instruction" (Sumner & Werner, 1997, p. 3). Martin and Holz (2002) argue, "Ethics cannot be taught; rather what can be taught is a framework for evaluating ethical dilemmas and decision making" (p. 2). It is important to present diverse ethical frameworks so the student can have choices. Granger, Little, Adams, Bjorkman, Gotterbarn, Juettner, Martin, and Young (1997) pointed out that "Research has shown that the most effective way to cover this material is

to distribute ethics and social impact exercises and discussions throughout the curriculum" (p. 39). This study developed a matrix (a spreadsheet-like table) of ethical issues related to computer science courses. The matrix included selected examples, but not a complete list of ethical issues. The ethical issues represented by the table rows were: *individual responsibility*, *professional responsibility*, *access and equity*, *quality of life*, *system quality*, *intellectual property*, *privacy*, *risks and reliability*, *use of power*, and *integrity*. The courses represented as table columns were: introductory courses, computer organization, data models, management, programming, software engineering, and theory (Granger, et al., p. 39). The integration occurs at the intersection of the ethical issues and content areas. The ethical issues associated with data models is addressed in this dissertation since data modeling is a key activity in designing effective database tables. Additionally, Martin's (1997a) paper, "The Case for Integrating Ethical and Social Impact into the Computer Science Curriculum," provided support for the direct coverage of ethical issues in specific courses. Martin recommended both a separate and required computer ethics course and the integration of ethics into other courses across the computer science curriculum. Martin listed 12 recurring concepts with half of them directly linked to the ethics field (p. 114). In support of the integration of ethics, Martin (1997a) listed nine fundamental subject areas (see Table 2.1) in the computer science field (p. 114):

Table 2.1

Nine Fundamental Subject Areas in the computer science field

1) algorithms
2) architecture
3) artificial intelligence and robotics
4) database and information retrieval
5) human-computer communication
6) numerical and symbolic computations
7) operating systems
8) programming languages
9) software methodology and engineering

Martin (1997a)

Since the database area is not isolated from other computer science areas, all of the above areas relate to the database course. The areas that have the most direct influence on the database area are algorithms, database and information retrieval, human-computer communication, and software methodology and engineering. For instance, structured query language (SQL) is a programming language and establishes a means for human-computer communications.

Weltz (1998) proposed a staged progression for integrating ethics across the computer science curriculum. This is in agreement with Martin (1997a) in that the dedicated computer ethics course would remain while an effective level of integration would occur in the specific computer science courses. Gotterbam (1999) discussed the debate regarding whether the integration of ethics in computer science should primarily

be an "attachment" or a "synthesis" approach. A required and dedicated computer ethics course is utilized to implement the attachment approach. In a discussion of engineering ethics, Bothwell (1999) is in agreement with Weltz (1998) with the statement, "We think ethics should not only be integrated within existing courses, but should be sequentially developed throughout the engineering curriculum" (p. 1).

By the turn of the century, more details emerged concerning the effective integration of ethics into the computer science course of study. In reference to Martin (1997a), Pliagas (2000) stated, "Martin hopes professors will teach the course in a more integrative and robust way than in recent history. Ethics should be taught in many classes instead of being solely focused as a separate course" (p. 40). Buerck (2001) proposed a four-step method for integrating ethics in the computer science curriculum consisting of "(1) declaration of the ethical value learning goal, (2) course selection, (3) identification of specific course content, and (4) teaching methods and assignments" (p. 167). Buerck, which discussed the experience of incorporating ethics into two required computer science courses: provided suggestions for course content, teaching methods, and assignments to increase the integration effectiveness. Concerning the education of information system professionals (computer science students), Prior et al. (2002) recommended that educators should, "address ethical issues more extensively in their curriculum" (p. 31). Prior's claim reinforces and is in agreement with the findings of Roelants (1996), Granger et al. (1997), Martin (1997a), and Buerck (2001).

The Research Center on Computing and Society at Southern Connecticut State provides information concerning teaching computer ethics. The Southern Connecticut State web site addressed issues related to computer science faculty having a lack of

experience with ethics, using case studies in the core computing courses, and utilizing the senior project as a final integrative experience. Martin and Holz (2002) of the Research Center on Computing and Society said, "The most serious problem in implementing this integrated approach across the computer science curriculum is the lack of familiarity that most professors have in locating and preparing materials to deal with the social and ethical issues" (pp. 3-5). This research agrees with this researcher's observations and White (1995) who suggested that professors are not aware of the professional ethical standards. In advocating an interdisciplinary approach, Tavani (2002a) debated the question of whether philosophers or technical people should teach the ethics component of computer science courses. This notion was in response to Martin and Holz (2002) and White (1995).

The AITP IS '2000 model course of study is widely used by colleges particularly in the information systems area. Students most directly encounter ethical issues in the applied area of computer science. Additionally, colleges extensively use the ACM/IEEE *Computing Curricula 2001*and AITP recommendations as a means to standardize the computer science curriculum. The joint task force on "Year 2001 Model Curricula for Computing: CC-2001" does address ethics to some extent. In knowledge area focus group 13 entitled "Social, Ethical and Professional Issues", there exist several items that are currently being reviewed.

The final report of the IEEE Computer Society and ACM entitled, *Computing Curricula 2001* provided the standard for the modern computer science undergraduate course of study (Chang and Denning, 2002). The curriculum model recommended a

separate course in social and professional issues and provided an initial framework for the integration of related issues into the technical courses (Chang et al., 2002, p. 25).

For the information management (database) area, the *Computing Curricula 2001* model included the topics of *information privacy*, *integrity*, *security*, and *preservation* in the first overview unit (IM1) (p. 145). Since this is an introductory unit, any discussion of ethical issues has to be very general and not connected to any specific technical content. The 2001 model does not address any ethical issues in the detail sections until the last unit concerning digital libraries. This elective unit involving digital libraries (IM14) includes the topics of *intellectual property*, *privacy*, *protection*, *archiving and preservation*, and *integrity* (Chang et al., 2002, p. 151). Other areas relating to the effective design of database tables, the use of query languages, database administration, data mining, and multimedia presentation lack any recommendations for the inclusion of ethical topics. The ethical content appears only in the course introduction (IM1) and the last elective module (IM14) with the remaining units representing purely technical material. It is precisely in the technical areas that the discussion of related ethical issues is most valuable. There needs to be a distribution of ethics throughout the database course in a way that enhances the coverage of traditional content without detracting from the learning of the technical material.

The Accreditation Board for Engineering and Technology, Inc. (ABET) is involved with the accreditation of engineering programs in computer science. The document entitled, *Questionnaire for Review of the Computer Science Program* allows the evaluation of various observations concerning the quality of a particular computer science program. The questionnaire includes various curriculum standards as a baseline

for evaluation. These standards recommend a predetermined number of credit hours for each area of study for particular degrees in computer science.

Standard IV-17 of the *Criteria for Accrediting programs in computer science in the United States* includes the comment: "There must be sufficient coverage of social and ethical implications of computing to give students an understanding of a broad range of issues in this area" (ABET, 2002). Additionally, the ABET document stated that the social and ethical implications should be included in selected course descriptions. This document makes clear that not every course must cover the ethical and social issues. The ABET organization clearly supported the notion of integrating ethics within the overall curriculum. While ABET supported the integration, the group provided little guidance concerning the ethical content and leaves that aspect up to each individual professor. This lack of specific guidelines represents a "gap" in the computer ethics knowledge base. The "gap" relates to a lack of guidelines for the integration of ethics that computer science professors need to meet the accreditation requirements. ABET suggested, "This is not intended to suggest that every course must have some coverage of each of these topics." Therefore, the ethical content could vary greatly from professor to professor and from institution to institution. The work of ABET pointed in the right direction but lacked any recommendations regarding the ethical content that is needed within each computer science course.

The most aggressive work toward integrating ethics throughout the computer science curriculum surrounds the ImpactCS project, funded by a grant from the National Science Foundation (*ImpactCS*, 2003). According to the authors of the ImpactCS report, the problematic areas involved with the integration of ethics into computer science

courses relates to a lack of a well-specified definition of the content, lack of materials, and a lack of faculty awareness and expertise. White (1995) and Martin and Holz (2002) addressed the lack of faculty awareness concerning ethics in previous studies. In the ImpactCS section, "Integrating Ethics and Social Impact into Existing Courses," there was a suggestion to describe the ethical issues in conjunction with a programming assignment (ImpactCS, 2003). Huff and Martin (1995) had been an early supporter of including ethical issues in programming assignments.

In describing the ImpactCS project, Werth (1997) mentioned that the field of computer ethics was, "an interdisciplinary field just beginning to come of age. It demands technical knowledge combined with a deep understanding of ethical and social principles and skills" (p. 5). The goal of the ImpactCS project was to pave the way for the integration of ethics in the computer science course of study at the undergraduate level. While the awareness of the necessity of integration was increased, much work remains before the effective integration of ethics is a reality. To advance this work, students in programming courses could explore the relationship between technical topics including exception handling and being morally responsible. Database students could discuss the implications of ineffective table design and the importance of sufficient security to maintain privacy. Professors can address specific issues relating to the broad categories of integrity, privacy, property rights, and responsibility within the full spectrum of computer science courses. These discussions form the foundation for more effective moral decision-making in the future.

In the final report of the ImpactCS project Martin and Weltz (1998) recommended the integration of ethics across the computer science curriculum. In a capstone report,

Martin (1997a) provided various ideas for including ethics in the technical courses that form the core of the computer science curriculum. Martin (1999) provided four recommendations (see Table 2.2) for the effective integration of ethics in the computer science curriculum.

Table 2.2

Four Recommendations for Effective Integration of Ethics

1) An early introduction

2) Continued discussion

3) Integration of topics within courses

4) Maximum coverage with minimum overlap

Martin (1999)

The notion of an early introduction of ethical ethics in the computer science curriculum correlates with the findings of Leibowitz (1990) and Orwant (1991). Furthermore, the suggestion concerning the integration of (ethical) topics within courses agrees with the findings of numerous researchers including Roelants (1996), Granger et al. (1997), Martin (1997a), and Buerck (2001). While the ImpactCS project increased awareness, the knowledge gap continues to exist in the areas of a solid foundation for computer ethics and a set of guidelines for computer science faculty. While this set of literature has identified the need for the effective integration of ethics into the computer science course of study, there remains a need to identify course content and teaching approaches. The next section examines issues that have a direct relationship with the database course. After a consolidation of various ethical particulars, the issues of

integrity, *privacy*, *property rights*, and *responsibility* emerge as the primary areas of concern for the database area of computer science.

Database-related Issues

After an analysis of a large volume of computer ethics literature, the researcher concluded that the primary ethical issues associated with the database course were *integrity*, *privacy*, *property rights*, and *responsibility*. The next section examines the literature with a specific focus on each of these primary areas of ethical concern. The purpose of this section of the literature review is to identify ethical issues that have a close relationship to the database area of computer science. The writing style of changing the context from one topic to another within each of the primary areas of ethical concern, especially the area of responsibility, is deliberate due to the broad scope of each area. This technique allows for a greater extent of coverage of ethical particulars. Furthermore, the greater extent of ethical coverage results in a higher level of understanding and proficiency regarding the primary areas of ethical concern within the database context.

Integrity

The concept of integrity is an important issue for computer scientists. Integrity has a direct relationship to both software reliability and data accuracy. Software reliability results from effective software engineering and data accuracy emerges from database design and management. The concept of integrity consists of both program and data accuracy and forms the basis of software reliability.

Concerning the issue of integrity, Mason (1995) described crucial points called "moments-of-truth" when a moral agent decides to change either the state of information

or some aspect of the information technology. Some examples were "changes in hardware, software, information content, information flow, knowledge-based jobs, and the rules and regulations affecting information" (p. 55). Many times the ethical issues that emerge from these "moments-of-truth" situations are unintentional. Such changes to the computing environment can degrade the integrity of the overall system. Database administrators have to be aware of and manage these "moments-of-truths" effectively to maintain high-levels of system reliability. In the database area, the more serious problems occur outside the scope of these exceptions when deliberate unethical acts occur.

Software engineering, the area most associated with changes in software and other "moments-of-truths", deals with the design and development of effective computer programs. Like other areas of engineering, software engineers use the concept of hierarchy to deal with complexity. Weiss, Parker, Baker, and International (1990) recognized two software-engineering issues in a 1990 article that remains very relevant in the current software development climate. The first revolved around producing new software built upon existing programs. The ethical issues relate to whether the product is new or simply a modification of an existing software package. The second issue addressed the marketing of a software product known to have bugs. A common case is the marketing of "vaporware", a product not yet completed. Both of these ethical problems have a close association with the application's supporting database. Programmers often retain existing database structures when existing programs form the basis for new software. Many times, an existing database is not modified to reflect the new software requirements. This often results in an ineffective database for the new

application. Unused attributes and inefficient key structures are characteristic of such databases.

Concerning the development and modification of computer programs, Gotterbarn (1991) argued that ethical problems in software engineering involve "the end product, the process of developing the product, and the human interactions in the development of the product" (p. 266). Gotterbarn's concern involving the end product re-surfaced when Collins, Miller, Spielman, and Wherry (1994) examined the software engineering question of "How good is good enough?" with the general conclusion that "practitioners in the software process from the manufactures to the users, have ethical responsibilities to minimize risks found in and derived from their share of the software process" (p. 90). When practitioners lack responsibility, software reliability deteriorates and software failure can occur. The problem of software failure was the central theme in a paper on the ethical considerations of software-dependent organizations (Carlisle, 1999). Software can make these organizations, "Vulnerable to the potentially harmful effects which can result from software failure" (Carlisle, 1999, p. 251). Software failure can result from database problems in addition to poorly written computer programs. Concerning the credibility of computing technology, Tseng and Fogg (1999) listed the problematic issues associated with the topic of "believability" as: "when computers act as knowledge repositories, provide instruction, report measurements, report on work, report on their own state, run simulations, and render virtual environments" (pp. 40-41). The authors found, "Once users perceive a computer product lacks credibility, they are likely to stop using it, leaving it no opportunity to regain its credibility" (Tseng & Fogg, 1999, p. 42). In an analysis of the ethics of safety-critical systems, Bowen (2000) illustrated seven

undesirable software engineering practices to avoid in the development of systems that are safety-critical. The practices related to the following: used for effect, exaggeration, too trusting, rule by a few, transitory, additional words, and meandering (pp. 92-93). The issue of trust relates to the concept of database integrity. The people who are responsible for the integrity of database environments must ensure the existence of effective edit rules and the elimination of duplicate data.

Several researchers address specific integrity-related issues. For example, the cases of a systems analyst covering up illegal activity and a programmer who cleans the hard drive if more than one copy of a given program is attempted were two instances of moral dilemma that could appear in a wider analysis of integrating ethics in the computer science curriculum (Pliagas, 2000). Thomson and Schmoldt (2001) included many ethical issues including *design*, *privacy*, *accuracy*, *authorship*, *accessibility*, and *quality of life* in a paper on ethics in software design and development. In the area of design, Thomson and Schmoldt (2001) said that "There should not only be a focus on how people use information, but also on how people misuse information or systems, explicitly indicating how a system should not be used" (p. 87). Thomson and Schmoldt (2001) suggested several notions regarding accuracy including software complexity, models, subjective judgment, language and culture, and information filtering. Many of these aspects of technology have a strong relationship to database design and development, in particular, models and information filtering.

Concerning accuracy, the public company accounting reform and investor protection law known as the Sarbanes-Oxley Act of 2002 helps to provide a solution for corporate integrity-related system problems. The act states that management has a

responsibility for establishing and maintaining adequate internal control structures and procedures for financial reporting. Furthermore, management must provide an annual assessment concerning the effectiveness of internal control structures and procedures. Additionally, accounting firms that prepare audit reports for public companies must attest to and report on the management's integrity assessment. Just as any other engineer, software managers and engineers have an ethical responsibility to address moral concerns within the products they design. This accountability involving system integrity extends beyond the information technology department to the level of senior management where the software engineer's work becomes a key component to the overall compliance of the Sarbanes-Oxley requirements. The issue of integrity extends beyond accuracy to the broad virtues of excellence and responsibility.

Privacy

Orwell's classic book, *1984*, while having totalitarianism as its central theme, also addressed technology as it relates to privacy. The omnipresent television monitors and Big Brother watching in the book were a form of technology, but not of computers. Many of the technical aspects found in the book *1984* are now possible with modern database and Internet technology. The concept of privacy has recently become even more important with the rapid growth of databases and needed government anti-terrorism initiatives.

The massive growth of database technology leads to the topic of data mining, the search and analysis of current and historical information stored in modern database environments. In studying the area of data mining, Fule and Roddick (2004) defined privacy as, "an individual's desire and ability to keep certain information about

themselves hidden from others" (p. 159). The problems associated with privacy represent the most important ethical issue in computer ethics. As a greater amount of personal data is stored and distributed within the Internet, the problems are magnified to an extent that privacy becomes one of the major issues of the computer age. In a study of invasive software, Lawton (2002) discussed several ethical issues including *spy ware*, *email tracking*, *web beacons*, *cookies*, *the magic lantern*, *pop-up downloads*, and *pop-over ads*. Many of these technologies are unethical and have formed the foundation for such activities as identify theft. The term, "Phishing" is used to describe the sending of email to a user falsely claiming to be a legitimate organization with a sole objective of obtaining personal and private information.

The computer science area of database technology provides a central focal point for the issue of privacy. With the exception of email, the information that privacy pertains to resides in modern databases. The ethical issues surrounding database technology have always been important even in the old non-networked environments before the Internet. The importance of database technology has grown in intensity with the Internet and World Wide Web. All of data captured in web pages for transaction purposes ends up in database environments.

The issue of privacy provides a focal point for recent acts of Congress. In a Willett (1987) dissertation, the Buckley Amendment provided the primary focus in conjunction with the issue of privacy in higher education. In the United States, the recent Patriot Act has increased the security of Americans, but the privacy issue has remained an item of discussion.

The review of the literature has found that a number of privacy related problems have appeared within the context of the Internet. Eichmann (2002) defined a Web spider as, "a program that automatically explores the structure of the Web and takes action upon the artifacts thereby encountered." The author presented a balanced discussion involving both the benefits and hazards of utilizing Web Spiders. The benefits associated with Web Spiders include the cataloging of web pages by major search engines.

One of the most important applications of the Internet is email. This area is not immune to unethical behavior. The issue of privacy is one of the ethical concerns that remains most associated with email. Sipior and Ward (1995) concluded that due to the balance between personal privacy and employers' proprietary concerns, "organizations must formulate their own internal email privacy policies" (p. 54). The use of email allows human kind to communicate on a global scale must faster than regular mail and in more ways than the telephone. The Internet provides the foundation for the communications transformation that will continue during the twenty-first century. While the Internet is one of the wonders of the technological age, many individuals who promote unethical behavior have found refuge in this important communications technology. The issue of privacy within the domain of email remains a top priority for researchers in computer ethics.

Concerning the related area of information ethics, Smith (1996) studied the traditional librarianship issues of privacy and opposing censorship. According to Cottrell (1999), the issue of client trust emerges from the conflict between a library's responsibility to provide open access to the World Wide Web and "the responsibility to protect the confidentiality of the transactions" (p. 110). With the advent of advanced

information technology, the modern library remains at the front lines in the computer ethics battle.

Tavani (2000) proposed that privacy concerns within the scope of the Internet could be classified under the headings: "(1) *dataveillance and data gathering*" and "(2) *data exchange and data mining*" (p. 4). In the area of data mining, Fule and Roddick (2004) proposed a system that can alert database administrators of any inadvertent misuse regarding privacy and ethical sensitive situations. The authors said, "The system works by storing ethical and privacy sensitivities associated with individual items separately to the data mining results" (p. 161). Ethical and privacy sensitivities (0…10 with 0 indicating no particular sensitivity) that are associated with individual data attributes are stored in the system. Fule and Roddick (2004) further described the system with the comment, "The system operates by checking each rule in the result set against any sensitivities that may be associated with the rule's composite items using a sensitivity combination function (SCF)" (p. 161). The system invokes a sensitivity combination function (SCF) when a data mining rule process becomes active to form a sensitivity rating for the rule. Based on the function's reaction to the set of sensitivity codes encountered, the system can generate alerts to the database administrator. The problems with this approach involve the subjective nature of determining sensitivity levels for each item and the effect of combining multiple items within a single mining operation.

The global connectivity of the Internet transforms the issue of privacy from a corporate computer center problem to a central issue within the telecommunications and commercial info structure. With the Internet, privacy transcends personal databases and extends to confidential information stored in accessible database environments. The

ethical issues range from using transaction history for commercial gain to identity theft. According to Berghel (2000), identify theft is made easier by the unnecessary utilization of social security numbers as primary database keys in all segments of society. Berghel (2000) continued to state, "SSNs are the holy grail of identity thieves. With these numbers, one can potentially access all of the databases that use SSNs as primary database keys" (p.20). Identify theft is a growing problem that must be addressed by database professionals in all technical areas including design, development, management, and security.

Adam (2001) examined various issues regarding online sexual harassment, such as cyber stalking. Adam insisted that feminist ethics could help in understanding the behavior that drives such inappropriate actions. With an expanded scope, Adam suggested that feminist ethics might offer fresh insights into computer ethics in general. Activities involving cyber stalking are among the problematic privacy related ethical issues encountered by the computer ethics community. Various cases regarding "stalking on the Internet" were utilized in an analysis of the uniqueness of computer ethics (Tavani, 2002b). In one case, an individual's residence, employer, vehicle, and other personal information were posted on the Internet. Tavani (2002a) mentioned that among scholars who consider computer ethics as being unique, cyber stalking could be considered a "different kind of crime from stalking in the 'offline' world" (p. 39). The author continued with the question of whether the Internet has made a moral difference in this particular class of moral issues.

Thomson and Schmoldt (2001) suggested that the concept of "data fusion" occurs when "access to separate data sources is used to combine information" (p. 88). This

involves the use of multiple databases in the process of violating the privacy of individuals. Additionally, Thomson and Schmoldt examined other areas including location privacy and the utilization of public information.

Employee monitoring is one area that utilizes database technology to achieve corporate performance objectives. Godfrey (2001), proposed an ethical model of employee monitoring with an analysis of both the effectiveness and acceptability of the approach. Godfrey (2001) defined a number of factors including usage, directness, universality, openness, involvement, continuity, proportionality, consequences, and enforcement within the context of electronic work monitoring (p. 19). Panko and Beh (2002) explained the legal basis of employee monitoring for two Internet abuses. These abuses were related to sexual harassment and the privacy of data on desktop computers. In the latter case, Panko and Beh (2002) noted that, "employees have little privacy interest in the data they store on their computers or how they use the Internet on their employer's equipment" (p. 86).

Software testing provides opportunities for the invasion of privacy by technical people. To reduce the exposure of confidential data during the process of application testing, Wu, Yongge and Yuliang (2003) provided a methodology whereby a mock database is generated from the live environment for testing purposes. This mock database excludes confidential information and is, "close-looking to the live production database for database application testing purpose" (p. 127). According to Olivier (2003), there needs to be a balance between *confidentiality*, *integrity*, and the *availability of personal data* stored in database environments. Olivier suggests that, "To achieve such a balance, technological means should be developed" (p. 20). Additionally, Olivier stated

that the solution involves both a notion of informed consent along with various technical measures. The proposed technical solutions revolved around the identification of the legitimate need for such information. With a clear legitimate need, Olivier suggested either encapsulation or the utilization of pointers to provide the proper balance between confidentiality, integrity, and availability.

Britz (1997) addressed what he referred to as the Christian perspective of information ethics with three central ethical issues: *power*, *dependency*, and *human rights*. More specifically, these issues included the topics associated with the *access of information*, *ownership*, and *privacy*. Guidelines for information professionals based on the norms of love, justice, freedom, truth, and human rights were developed (Britz, 1997). Such issues as love and human rights are important and should be considered as valuable virtues when examining the facts associated with database-related ethical decisions.

A password and a few operating system features were sufficient during the early period of information management. In the current world of global connectivity, new measures are needed to keep confidential information private. Privacy is an important goal and must be maintained at all costs to ensure the integrity of our present and future information society.

Property Rights

There is an enormous amount of literature in the property rights area ranging from the music download problem to the Digital Millennium Copyright Act (DMCA) of 1998. In a discussion of the philosophical foundation of computer ethics, Floridi (1999) stressed that, "Computer criminals often do not perceive, or perceive in a distorted way, the nature

of their actions because they have been educated to conceive as potentially immoral only human interactions in real life, or actions involving physical and tangible objects" (p. 40). This line of thinking and personal observations have led the researcher to suggest that many college students who do not see anything wrong in making illegal copies of software will rarely partake in any activity such as shoplifting. Teston (2001) revealed a difference in moral orientation toward tangible property and computer-based property among young children. Over fifty % (51.89) of the seventh-grade students surveyed advocated software piracy in contrast to only ten % (10.23) for bike theft. These results take us back to the issue of how tangible property is considered different from software-based property. This level of moral thinking extends beyond children to the adult population. The researcher's observations concerning the lack of moral transformation from the ethical thinking of children to adult thought patterns is reminiscent of Kohlberg's moral stage theory. Furthermore, Faucher (1992) asserted that with computers being intertwined with everyday life, cyber information has the same characteristics as concrete private property. Moreover, Yang and Ding (1999) found that most senior computer science students do not consider software intellectual property violation cases as software infringements or "feel guilt when they themselves are confronting these situations" (p. 116).

In contrast to user data, computer programs ranging from application software to operating systems that manage and process user data are themselves within the realm of intellectual property. Wagner (1998) proposed an ethical decision-making model based on foundations in moral philosophy, psychology, and business ethics specifically for the issue of software piracy. Wagner surveyed both graduate and undergraduate students

with data analysis indicating a strong support for the proposed model regarding piracy. Triplett (2002) analyzed the issue of copying software illegally using Bernard Gert's morality procedure with sufficient detail to claim, "It is morally prohibited to illegally copy software to benefit a friend" (p. 84).

In the area of software development, disagreements can occur involving knowledge possessed by individuals and organizations (Thomson & Schmoldt, 2001). The two ethical aspects associated with property were given as authorship and bandwidth. In relation to the common environment that bandwidth provides, Thomson and Schmoldt (2001) suggested the issue of *bandwidth limitation* as being a very technical ethical concern for both recipients and data providers (p. 96).

Involving the integration of ethics in computer science education, Yang and Ding (1999) identified the area of software *intellectual property rights* (IPR) as an important issue of universal concern. Yang and Ding (1999) found that approximately 75% of their senior-level student sample responded that computer software IPR violations should not be considered as serious as other computer crimes" (p. 116). Erickson (2003) examined the area of intellectual property with a specific focus on digital rights management's impact on fair use and trusted computing. Erickson addressed the issue of imposing rules on the end-user experience. Erickson (2003) identified several challenges, including coding copyright law and the possible negative effects of emerging technologies, to enforcing copyright restrictions (pp. 37-39). Each of the ten commandments of computer ethics (see Appendix M), developed by the Computer Ethics Institute in Washington, D.C., is closely connected with the property rights issue within the database area of computer science. Two of the commandments specifically relate to the property rights

issue. The sixth commandment stated that a person should not copy or use proprietary software. The eighth commandment said that one should not appropriate other people's intellectual output.

The examination of the broad ethical issues confronting the computing community leads to the concept of responsibility. Computer professionals must become more aware of ethical issues and be responsible for effective engineering, management, and stewardship of computing resources.

Responsibility

The issue of responsibility is broad and has a direct relationship with multiple areas of computer science. Thus, this section will discuss ethical issues from a diverse set of computer science topics. In a 1995 study of student perceptions of computers as moral agents, seventy-nine % thought that computers had decision-making capabilities and forty-five % judged computers to have intentions (Friedman & Millett, 1995, p. 2). This study suggests that people believe that machines are partly responsible for computer errors. The belief that computers are responsible for system integrity illustrates a lack of understanding of the true nature of computer technology and the human issue of accountability.

There is a close relationship between the area of responsibility and software engineering. White (1994) discussed the reliability of a system needed to sustain human life and aspects associated with those who should be held responsible when critical software fails. White (1994) presented the question, "What is the responsibility of a programmer who discovers the program under development is to be used by individuals to commit some form of 'white collar' crime" (p. 172)? This is extremely important and

should be one of the primary areas for integration into the database course at the undergraduate level.

In a report concerning integrating ethics and social responsibility across the computer science curriculum, Martin and Weltz (1998) included the issues of *digital forgery*, *data ownership and control, embezzlement*, the notion of "*good enough*", *netiquette*, *reverse engineering*, *exception handling*, *vaporware*, and *differences among developers and user perceptions* (pp. 2-3). The items that have the most significant impact for database administration are *digital forgery*, *data ownership and control, embezzlement*, and the notion of *good enough*. The engineering problem of *good enough* is specifically related to the use of normalization during the process of designing effective database tables. Programmers must be held responsible for effective exception handling in their source code. Exception handling techniques (i.e. try and catch in c++) offer a means to trap problem occurrences and provide effective solutions to such situations.

Harrington (1992) focused on the individual characteristics of computer abusers. Harrington identified the concepts of *moral perspective* and *denial of responsibility* as two of the characteristics associated with computer abusers. A distinction exists between the content of ethical study and actual ethical lapses. The content category pertains to ethical questions, issues, and concepts that make ethics important for humanity. Moral lapses are wrong actions that can range from being legal but unethical to being an actual crime. While these two categories can diverge in ethical analysis, it remains important to remember the distinction. One finding related to a "*lack of clear standards*" with a

reference to "*self-standards*" (Harrington, 1992). Our thoughts travel back to a path to character-based ethics with the notion of "self-standards."

In Moor's classic 1985 paper, the primary theme revolved around the concept of a "*policy vacuum*" that existed in the relationship between the ethical issues of computer science and the actions of practitioners in the field. Moor (1985) suggests that the "*logical malleability*" of computers represented the distinct characteristic that placed computer ethics apart from ethics in general. Logical malleability relates to the universal nature of the computer. In contrast to many machines in the past, the computer is a truly multipurpose tool. Software makes the computer malleably because program instructions change the internal logic to behave in some predetermined way. Moor (1985) said that the driving force is, "How can we mold the logic of computers to better serve our purposes" (p. 27)? Several areas including *intellectual property*, the concept of a *cashless society*, *voting*, *privacy*, *invasion of property*, *surveillance*, and *trust* have a strong relationship to the effective use of modern databases. It is the responsibility of information technology professionals to maintain a high level of user trust regarding hardware, software, and data accuracy.

Grainger, et al. (1997) distinguished between individual and professional responsibility. While professional responsibility involves inherence to professional codes of ethics and the expectations of society, individual responsibility relates in a deeper sense to one's internal state of character as is characteristic of virtue ethics.

Fisher, Gillespie, Harshman, and Yeager (1999) focused on the ethical and legal dimensions of Internet *whistle blowing*. This paper suggested how Cyberspace has provided new dimensions along which to understand the phenomenon of whistle blowing.

The issues of licensure and the role of personal contact appeared in a paper by Keys (1999) on professional responsibility in the practice of medicine on the Internet. These same issues emerge in the area of Web counseling.

Artz (1994) examined several issues that promoted virtue ethics over utility in computer ethics. Artz (1994) provided questions concerning the *ownership of design ideas*, *collecting data about individuals*, *database integrity*, *responsibility*, *software reliability*, *misuse of resources*, and *employee monitoring*. The notion of unauthorized access is related to both the privacy issue and a lack of effective security. To reduce harm, the overall stewardship plan must have an effective level of security and make fairness a priority. Cottrell (1999) addressed the issues of *privacy* and *confidentiality*, *acquisitions* and *collection development*, *archiving and preservation*, and *deskilling and gender bias*. Cottrell stated that reliance on computers raises questions about the preservation of information for the future. Future generations will be harmed if our knowledge becomes unavailable.

The Christian perspective regarding computer ethics was the central theme in Schultze's (2002) book, *Habits of the High-Tech Heart.* Shultze promoted a foundation for computer ethics based on Christian ethics. Schultze (2002) addressed the rapid pace of our technological progress from a Christian framework including the handling of moral wisdom within a religious tradition involving, "A shared memory, caring practices, and mutual accountability" (p. 71). The issue of responsibility is inherent to the Christian mindset and reinforces the practice of accountability in the computing community.

Database security is an important element in database administration. The notion of security is more of a proactive measure or means than an ethical issue. The ethical

issue arises when there is a lack of security in a database environment. A sufficient level of security needs to be in place for the utilization of an ethical and effective database. Therefore, it is the responsibility of computer professionals to maintain a proper level of security at all technical levels.

Harrington (1992) investigated ethical judgments in the computer profession with an examination of the issues of *destruction of computer data*, *fraud*, *hacking*, *sabotage* of computer systems, the *lack of clear standards*, and the *effects of peer pressure*. While the lack of clear standards results from poor system management, the other situations result from insufficient security. Harrington's notion concerning a lack of clear standards reinforces the policy vacuum observation of Moor (1985). Kowalski (1994) developed a "security by consensus (SBC)" model for a syntheses of ethical, political and legal, operational and managerial, and information technology security constraints. Knowalski brought together the various dimensions associated with the security aspect of managing a computing environment.

Concerning the psychology behind unethical behavior in computer science, Floridi (1999) stated, "The agent often perceives computer crimes as games or intellectual challenges" (p. 40). In an analysis of the philosophical foundation of computer ethics, the concept of *vandalism* was the subject of a study involving ethical theories (Floridi, 1999). Floridi maintained that the concept of vandalism has a close relationship to *hacking* and *computer security*. In a paper concerning cognitive hacking, Cybenko, Giani, and Thompson (2002) presented the issues of *bogus news reports*, *misinformation*, and *unauthorized modifications* for discussion and analysis. The issue of

security affects all aspects of computer science from network hardware to the data that resides in corporate servers.

The technical aspects of security pertain to installing software patches, the full utilization of operating system features, the effective use of built-in database protection features, and understanding network weaknesses. The concept of responsibility emerges as a key element in the process and practice of maintaining an ethical computerized database environment.

The World Wide Web provides a significant site where computer ethical dilemmas have and will continue to emerge. The ethical issue of responsibility extends to the areas of *advanced cyborg research*, *gender issues*, *workplace concerns*, *distance learning*, and *online psychological issues*. These areas of ethical concern share a common thread with advanced database technology, especially when data base management systems are intertwined with the global connectivity of the Internet. The literature review suggests that most of the current research in computer ethics is related to the Internet. Many of the ethical issues that have found a home in the global network are actually the same problem areas that were present in the pre-Internet computing environments. The character-based theory of ethics that is constant in time and place provides little difficulty in addressing these so-called new moral questions. Many of the issues found within the realm of the Internet have a close association with the database area of computer science. The importance of responsibility in the database area is increased significantly with the cohesive nature of database technology along with the global computer network.

In 1960, the terms cybernetics and organism were combined by Manfred Clynes and Nathan Kline to form the term cyborg (Gray, 2001, p. 11). In the book, *Cyborg Citizen*, Gray (2001) stated, "A cyborg is a self-regulating organism that combines the natural and artificial together in one system" (p. 2). Gray provided excellent insights into the cyborg phenomena and how this technology has already provided benefits for humanity. In response to such advances as cyborg research and artificial intelligence, Anderson (1997) argued that ethics must determine the direction of our society instead of technology. He mentioned that, "The technological ability to do something is not the same as a moral imperative to do it. Technology should not determine ethics" (p.6). This statement supports a stronger foundation not only for the computer ethics field but also for other areas of human endeavor. Additionally, Gray suggested that this technology could be misused and that we should be aware of the implications as we move toward a new level of human existence.

The discussion of the Biotechnology revolution in *Our Posthuman Future* mirrored many of the consequences found in computer ethics (Fukuyama, 2002). Such issues as human nature, artificial intelligence, and the protection of values are closely related to the study of the consequences of the computer age. Fukuyama's analysis of the future consequences of the Biotech revolution is relevant to computer advances that are certain to occur. Fukuyama's (2002) final remarks in the book were, "We do not have to regard ourselves as slaves to inevitable technological progress when that progress does not serve human ends. True freedom means the freedom of political communities to protect the values they hold most dear" (p. 218). Gray's (2001) analysis of the impact of future cyborg research echoed a similar level of caution. Database professionals need to

remain alert to the ethical ramifications of advances in computer science and avoid letting technology be the determining factor.

The concept of responsibility extends beyond technology to such items as gender-related issues. Gottleber's (1992) dissertation examined undergraduate students with a focus on their attitudes and knowledge of the ethical use of computers. Gottleber found that women had a significantly greater knowledge of ethics. Research concerning various gender issues continues to be a computer ethics focal point. Gilligan (1982/1993) provided the initial impetus for computer-related gender research. Kreie and Cronan (1998) found that men and women were distinctly different in their assessment of what is ethical (p.76). The study found that men were less likely to view an action as unethical and women were more conservative in their ethical decisions. With the computer field being primarily represented by the male population, the results of this study could explain some of the unethical actions that are associated with the computer science field. Additionally this study suggests that a priority should be given to teaching the ethical component in the computing curriculum. The main problem is that the computer science field is and has been dominated by males. The mystique of the computing field needs to be lifted so more high school girls feel comfortable in the computer science classroom.

Adam (2000) addressed various gender issues such as cyber stalking in a paper concerning the association of gender and computer ethics. Adam (2000) noticed a lack of reference to the large body of writings involving feminist ethics in the computer ethics literature. There have been a number of studies involving feminist issues in computer ethics and the pace of this research will increase. Adam suggested that feminist theories are not being fully utilized in the interdisciplinary research involving ethics and

computers. Adam (2001) examined the "inequalities between the genders in relation to aspects of the use of computers" (p. 236). In an agreement with Anderson (1997), Adam (2001) saw a "technologically determinist" position in computer ethics where technology determines how society acts rather than the opposite approach. The discussion of gender issues leads to various ethical problems found within the workplace.

While computers are seen as timesaving tools that improve the quality of life, Thomson and Schmoldt (2001) remarked, "systems may actually degrade the quality of working life" (p. 98). The problems were said to relate to the deskilling of the workforce, increased stress, and health and safety concerns. The central ethical issue of "harm" is reflected in the statement, "A system should not increase the harm to the least advantaged, or risk increasing harm in already risky environments" (Thomson & Schmoldt, 2001, p. 98). Issues associated with the "digital divide" and the opportunities of equal access appeared in a paper that asked the question, "Has the United States reached a point where access to the Internet is necessary for education, employment or similar right" (O'Neil, 1999, p. 6)? This research highlighted the importance of the Internet in such vital areas as education.

In an analysis of Internet abuse, Anandarajan (2002) mentioned that "employees squander anywhere from 30 minutes to three hours a day on non-work-related activity" (p. 53). In contrast to most research, one study cast doubt on the popular profile of the workplace Internet addict and suggested that frequent Internet users may often be productive and happy workers (Stanton, 2002, p.59). In a study associated with Internet service providers and educational acceptable Internet use policies, Siau, Nah, and Teng (2002) identified eleven Internet abuse variables including the *transmission of*

confidential data and *unauthorized usage and sharing of passwords* (pp. 76-79). The author concluded that policies need to address all Internet abuses to eliminate "gray areas." Again, this leads to Moor's concept of a "policy vacuum."

Another area relating to Internet abuse is the monitoring of employee Internet usage. In two studies, Urbaczewski and Jessup (2002) examined several questions regarding the electronic monitoring of employee Internet usage (i.e. net nanny and cyber sitter). The data supported the use of Internet monitoring especially with employee feedback as a means to reduce "*cyber slouching*" (p. 83). The research suggest that information technology professionals need to increase their awareness and display more responsibility regarding how computer science impacts the working conditions of fellow human beings. From the workplace, the ethical issues surrounding advancements in computer technology now extend to the education function of society.

The Internet has provided a framework for a transformation in education. Distance learning is an emerging application in computer science and has already transformed the education field. Concerning ethics and distance learning, Han (1994) suggested that distance can remove society's inequality and can be an important attribute in attaining the goal of "Reasserting ethics throughout society." Han identified five agreements concerning minimal case beliefs and values as "*the preservation of life*, *liberty*, *property*, *equality*, and *privacy*." Han maintained that the primary issues related to the *equivalence of product*, *student integrity*, *intellectual property*, and the *changing pedagogy associated with teaching online.* In the area of quality, aspects associated with the process, content, and delivery were included. Many of the ethical issues surrounding distance learning have a direct relationship with the database area of computer science.

The problems associated with distance learning will begin to decrease as the level of awareness involving ethical issues associated with the database area increases.

Caddell and Diekema (2002) described distance learning as a viable option, but not equal to the face-to-face interaction between professors and students. The use of satellites in distance learning is becoming more popular. These mobile units allow content providers to deliver courses from remote locations away from power and Internet connections. The ethical concerns are not isolated to the workplace and our educational institutions. The substance of computer ethics transcends these institutions and directly impacts the personal lives of those present in the online community.

The issue of responsibility extends to psychological aspects of computer use. Concerning the psychology of the Internet, Wallace (1999) provided various insights involving the psychological aspects of Internet use including such phenomena as *online masks*, the *focus on self*, *group issues*, *trust*, *auctions*, *guidance*, and positive consequences of the global communications media. Other areas of interest to psychologists include the possibility of *submittal messages* on the Internet and the ethics of online counseling.

One of the surviving fragments of the writings of Epicurus (trans. 1993) stated. "Live your life without attracting attention" (p. 101). This philosophy of "living unseen" has attracted new followers in this age of global communications. The human need for meaningful social interaction is not fulfilled by "unseen" online interactions with people hidden under the veil of cyberspace. One of the ironies of being virtually connected to everyone is that loneliness and depression can emerge from the "living unseen" philosophy of life. Concerning the correlation between Internet addiction and depression,

Young and Rodgers (1998) used the Beck Depression Inventory (BDI) as a tool for their experiment. The BDI is a simple instrument used by psychologists in the process of diagnosing depression. The article discussed implications for assessment and treatment where the Internet represents a variable in the client's overall psychological makeup. Young and Rodgers' research illustrated the growing problems of Internet addiction and online depression. It is interesting how technology interacts with the complexity associated with understanding the human condition.

Crystal, Geide, and Salpeter (2000) identified the issues of *pornography*, *violence*, *plagiarism*, and *stalking* in a teachers' guide to Internet safety. The authors stated that, "Young people consider hacking and plagiarism to be acceptable" (Crystal et al., 2000, p. 25). With a focus on high school related ethical concerns in technology, Kebbait (2001) addressed the issues of *Internet abuse*, *damaging other's work*, *violating copyright laws*, *breaking in someone's files*, *hacking*, *illegal software copying*, and *plagiarism*. Young and Rodgers listed several papers that focus exclusively on the problem of Internet addiction on their Web site (see www.netaddiction.com). These papers focus on such moral issues as *cyber sex*, *cyber affairs*, *cyber disorders*, *loneliness*, *gambling*, *depression*, *online auction addiction*, and other related issues. Some of the selected issues including cyber sex and gambling could, in certain situations, be illegal in addition to being unethical. The broad computing community needs to address such moral particulars as online loneliness, depression, and addiction. The Internet acts as a catalyst for an enormous range of problems that must be addressed on a global scale. Many of the problems of the Internet go beyond the scope of computer science and fall within the context of our social science disciplines. Computer scientists, especially those in the

database area, must maintain the integrity of the computer science field by acting responsibly and being aware of how their particular expertise is being used to affect other people and our shared environment on this planet or elsewhere in the universe.

How my dissertation fills the gap

This chapter provided a review of literature in computer ethics. This chapter investigated the emergence of computer ethics and provided a detailed discussion regarding the integration of ethics into the computer science course of study. The researcher then examined the literature in relation to the database-specific issues of *integrity*, *privacy*, *property rights*, and *responsibility*. The researcher showed through the review of the literature that discussions concerning the integration of ethics in the computer science curriculum intensified as the number of people affected by computer technology increased. While researchers in recent years have focused more on the integration of ethics within the computer science curriculum, a gap remains in the area of specific instructional recommendations for the integration of ethical issues into the database course.

Through this dissertation, this researcher has helped to fill this gap by providing recommendations for the inclusion of ethical issues along with the technical material in the central database course. The recommendations that match up with the IEEE/ACM technical content will assist computer science professors in meeting the standards involving the inclusion of ethical issues into their undergraduate database courses. The results from this dissertation will help contribute to the next step in making computer technology more ethical as human kind progresses through the twenty-first century and beyond.

The next chapter will present an overview of the research, list the research questions, and describe the researcher's hypothesis. The researcher will describe the survey population, the structure of the assessment instrument, the pre-survey communications and discuss the institutional review board (IRB) consent forms.

Chapter 3: Method

The goal of this chapter is to describe the research method for this dissertation. The first section provides an overview of the overall study including descriptions of the survey population and purpose of the study. The next section presents a detailed set of research questions that concern both teaching computer ethics in general and specific issues relating to teaching computer ethics within the database course. This set of research questions form the basis for the survey questionnaire. The remaining sections describe the hypothesis, population and overall structure of the assessment instrument. Finally, information is provided concerning the email letter that was sent to participants. The next section provides a broad overview of the research involving the integration of ethics in the database course.

Overview of the Research

The researcher will provide recommendations for a more effective level of integration of ethics in the computer science curriculum at the undergraduate level with a specific focus on the database course. The researcher identified in the literature review several ethical issues that have a direct relationship to the database course. These broad ethical categories included *integrity*, *privacy*, *property rights*, and *responsibility*. The survey instrument was given to a population of 50 computer science professors from small liberal arts colleges with a primary emphasis on Christian College Consortium (CCC) institutions. The researcher identified the entire population of CCC professors who teach computer science along with additional educators from similar institutions. Most of the professors were from the CCC schools with the remaining from colleges with very similar characteristics as the CCC schools. Many of the survey questions had a

direct relationship to the broad ethical categories found within the literature review. Table 3.1 provides a list of the consortium members.

Table 3.1

Christian College Consortium (CCC) Member Institutions and non-CCC Colleges

CCC Member Institutions

Asbury College, Wilmore, Kentucky

Bethel College, St. Paul, Minnesota

George Fox University, Newberg, Oregon

Gordon College, Wenham, Massachusetts

Greenville College, Greenville, Illinois

Houghton College, Houghton, New York

Malone College, Canton, Ohio

Messiah College, Grantham, Pennsylvania

Seattle Pacific University, Seattle, Washington

Taylor University, Upland, Indiana

Trinity International University, Deerfield, Illinois

Westmont College, Santa Barbara, California

Wheaton College, Wheaton, Illinois

Non CCC Colleges:

DePauw University, IN

Indiana University Kokomo, IN

Indiana Wesleyan University, IN

Kalamazoo College, MI

Millikin University, IL

Olivet Nazarene University, IL

Saint Xavier University, IL

The computer science professors from the above colleges teach and conduct research in the process of educating a new generation of computer science professionals. Additionally, these educators assist with the interface between current and future computer professionals. The researcher has hypothesized that the integration of ethics that is occurring at these colleges will not be at an effective level as demonstrated by the computer ethics literature. Data from the professors provided valuable information for the selection of course content for a more effective integration of ethics in the computer science curriculum at the undergraduate level. The information base consists primarily of the ethical issues as identified in the literature review. These ethical issues were sufficient for the establishment of an effective survey instrument that appears in Appendix C.

The researcher's purpose is to provide data that will help justify a greater level of integration of ethics in the undergraduate database course. The results of the study helped with the identification of areas that will require the greatest emphasis. The objective of the research is to increase awareness and provide direction, through the examination of ethical issues and sample case studies in Chapter 6, for the future development of a framework from which computer science professors can adjust their current instructional content in the database course to incorporate the ethical issues that have a direct impact on the technical details. This approach will instill into the students the importance of doing things right, including how their actions might have an impact on society in general. The key element is being able to teach ethical issues within the database course in contrast to mentioning the database area as part of a comprehensive Computer Ethics course. Currently, each professor operates independently in this area.

While most professors certainly address topics that may simply appear spontaneously during their lecture process, the educators do not utilize a set of organized principles that relate to the ethical concerns that are directly relevant to the particular course that they are teaching.

The results of this dissertation will make an important contribution to the field of computer science. The problems in the computing community are real, we read about them each day. Moreover, they are going to get worse. This research rests on the premise that the key element in changing society for the good of all people is education. With education, the computing profession and in turn society will be a better place as the human experience continues to the 21st century and beyond.

Research Questions

By surveying computer science professors from the selected population who prepare students for entry into the information technology profession the researcher hopes to gain insights about some of the following questions regarding the integration of ethics into the undergraduate database course? The primary research question and supporting sub-questions are as follows:

Do computer science professors from the population, in preparing students for entry into the information technology profession, effectively integrate ethical issues into the undergraduate computer science database course?

1. How are the computer science professors teaching computer ethics in the undergraduate technical courses?
2. With the effective integration of ethics in the computing curriculum, is it necessary to offer an upper-level capstone Computer Ethics Course?

3. Should there be a dedicated course in computer ethics? If yes, what level (Freshman through Senior) should it be?
4. What teaching approaches have been most effective?
5. Are ethical theories introduced before discussing specific cases in computer ethics?
6. Who teaches the ethical component within the computer science course of study? Are computer science, philosophy, or business ethics professors teaching the ethics component within the technical courses?
7. How are students evaluated in the ethics area?
8. Is there a difference between the set of ethical issues as identified by the literature review for the database course and what is taught by the computer science professors?
9. What ethical issues are not being taught in the computer science database course?
10. For each ethical item within the various sections of the database course, is there a difference between actual coverage levels and the importance level placed on such items by those professors who have not taught the database course?
11. What is the primary set of ethical issues that is presented in the computer science database course?

The researcher examined the primary research question presented in Chapter 1 and developed eleven supporting sub-questions that provide a greater level of detail regarding the primary inquiry. The first ten supporting sub-questions are included in the

survey instrument and multiple survey questions appear for each of the information management (IM) instructional units described in the ACM/IEEE curriculum model. The researcher developed the topics within each instructional unit in the survey questionnaire from his professional experience and analysis of the literature review.

Hypothesis

The hypothesis is that computer science professors from the population do not effectively integrate ethics in the computer science database course. Another way to state this hypothesis is:

Computer science professors do not effectively integrate ethics in their database courses and meet the other objectives of the class.

A counter position could be stated as:

There exist no differences between the selected population of computer science professors and the expectations of the researcher and external organizations (ACM, AITP, and ABET) concerning the effective integration of ethics in the computer science course of study.

Another way to state this counter position (null hypothesis) is:

The selected population of professors do effectively integrate ethics in their database courses and meet other course objectives.

Population

The population consisted of 50 computer science professors from small liberal arts colleges with a primary focus on Christian College Consortium (CCC) institutions. Most of the professors were from CCC member institutions. The remaining professors were from schools with very similar characteristics as the CCC group.

The Assessment Instrument

The survey assessment instrument consists of several demographic-related questions and specific database questions that correspond to the research questions described in the previous section of this chapter. The survey instrument contains three main sections: general information, general computer ethics information, and specific database course information. The general information questions were designed to collect various personal and demographic data including age level, race, gender, highest education level, and amount of teaching experience. The second section consists of questions regarding how computer ethics is taught, who teaches the computer ethics component, and how computer science students are evaluated in the ethics area. The third and final section deals with the level of coverage of ethical issues in the database (Information Management) section of the *Computing Curricula 2001* framework.

The purpose of the survey is to provide a baseline database for initial information regarding the integration of ethics within the database course. Additionally, the survey results can serve as a springboard for additional research. Reflecting the lack of comparison data, various tests for significance are not utilized in the data analysis. The researcher uses frequency analysis, means, and standard deviations in the analysis process presented in Chapter 4.

Email Letter to Participants

An email letter was sent to the participants that described the dissertation topic and provided additional information concerning the survey questionnaire. The letter is included in Appendix A of this dissertation.

IRB Forms

The IRB consent form representing Malone College and The Union Institute & University human research committees was included in the survey packet. The informed consent form is located in Appendix B of this dissertation.

This chapter described the method associated with this dissertation by examining the population, purpose and hypothesis. Several documents that are included in the appendix were mentioned including the survey questionnaire and email letter to participants. The following chapter presents the results that were obtained from the computer science professor survey.

Chapter 4: Results

In this chapter, the researcher presents results obtained from the analysis of the data acquired from the survey of computer science professors. The demographic and general computer ethics results contain frequencies and percentages supported by pie charts. Two tables illustrate the results for each of the specific database-related questions. The first table shows frequencies and percentages for each response option (1-5). The second table provides the mean and standard deviation for the two groups of professors (those who have taught the database course and those who have not taught the database course). The data and statistical results from this chapter form the basis of discussion in Chapter 5. The next section presents the raw data and results of statistical analysis.

Computer Science Professor Survey

Demographics

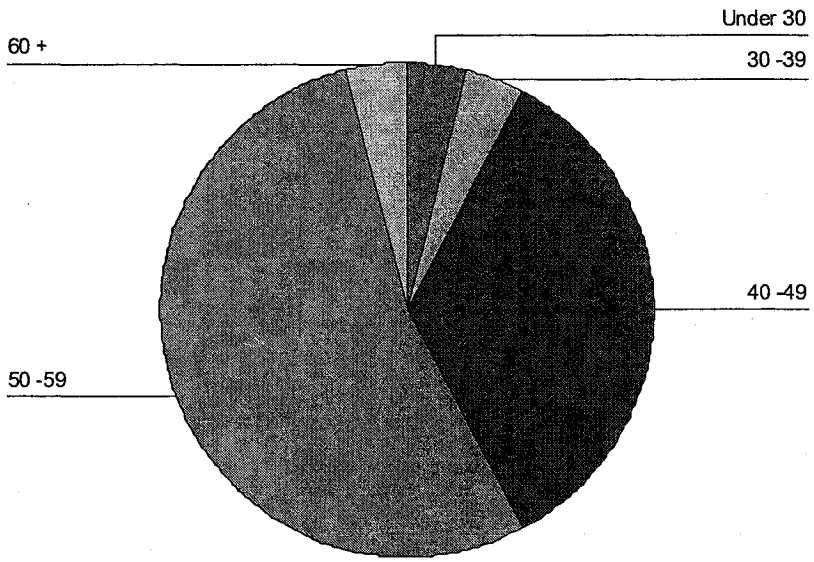
The following data is associated with survey question 1. The researcher received 26 completed surveys out of the total population of 50 computer science professors. This represents a 52 % return rate that is sufficient for the generation of meaningful information. The survey questions provided a context for the data analysis.

Of those who completed the survey, 14 individuals (53.8 %) of the professors were within the "50-59" age category. The "40-49" category was the second largest age distribution with nine people (34.6 %). Therefore, 88.4 % of the completed questionnaires were from individuals from 40 through 59 years of age. There was 1 person in both the "< 30" and "30-39" categories and 1 individual in the "60+" age

bracket. For this study, one individual represented 3.8 % of the data. Figure 4.1 illustrates the age categories for the survey participants.

Figure 4.1

Age Categories

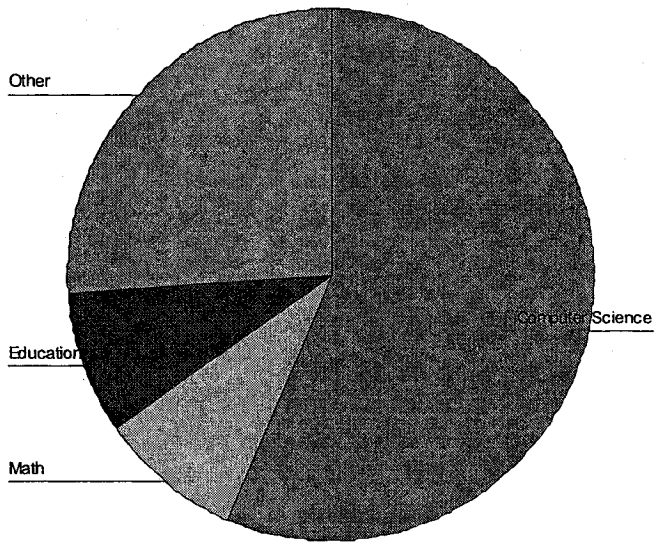


Concerning survey question 2, there was an even distribution in the area of formal education with 13 (50 %) with a master's degree and 13 (50 %) with a doctoral level degree.

The following data is associated with survey question 3. Concerning the highest degree discipline, 13 professors (56.5 %) had a graduate degree in computer science. The "Other" category was the next highest with six individuals representing 26.1 %. Perhaps some of the professors who selected the "Other" category had degrees in the engineering discipline. The education and math disciplines both had two people at 8.7 % of the total data set. Figure 4.2 shows the participant's highest degree discipline.

Figure 4.2

Highest Degree Discipline



Involving the gender (survey question 4) of the set of computer science professors, 4 were female and 22 were male. The female percentage was only 15.4 while the males represented 84.6 % of the people who responded.

Concerning race (survey question 5), 100 % of the respondents were white. No other race category was selected in the completed set of questionnaires.

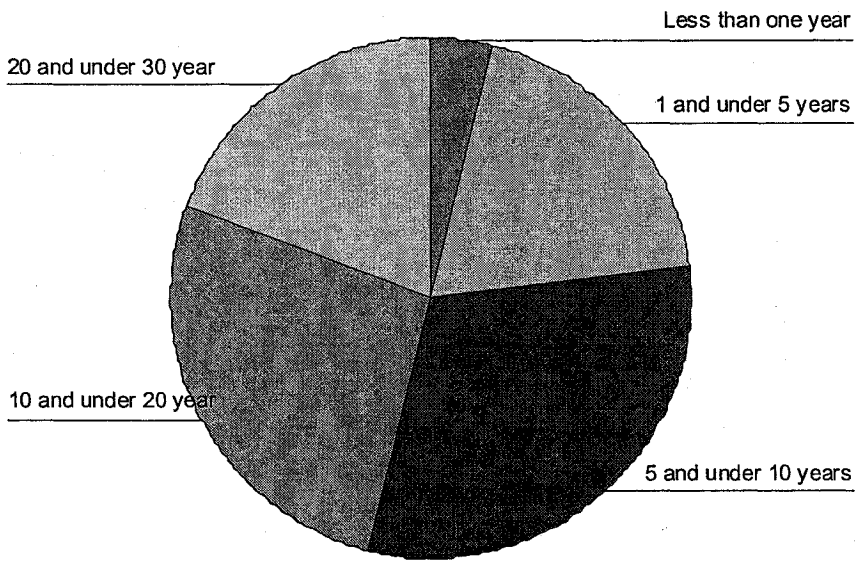
From survey question 6, it was found that most of the computer science professors worked in an urban setting. The data indicated that 17 (65.4 %) of the individuals worked in an urban setting in contrast to only 9 (34.6 %) selecting a rural category.

From survey question 7, there was an even distribution of data involving the number of years the professors had been in their current position. One individual (3.8 %) had worked in their current position for less than a year. There were five (19.2 %) in the "1-4", eight (30.8 %) in the "5-9", seven (26.9 %) in the "10-19", and five individuals

(19.2 %) in the "20-29" year category. Figure 4.3 illustrates the number of years the participants have been in their current teaching position.

Figure 4.3

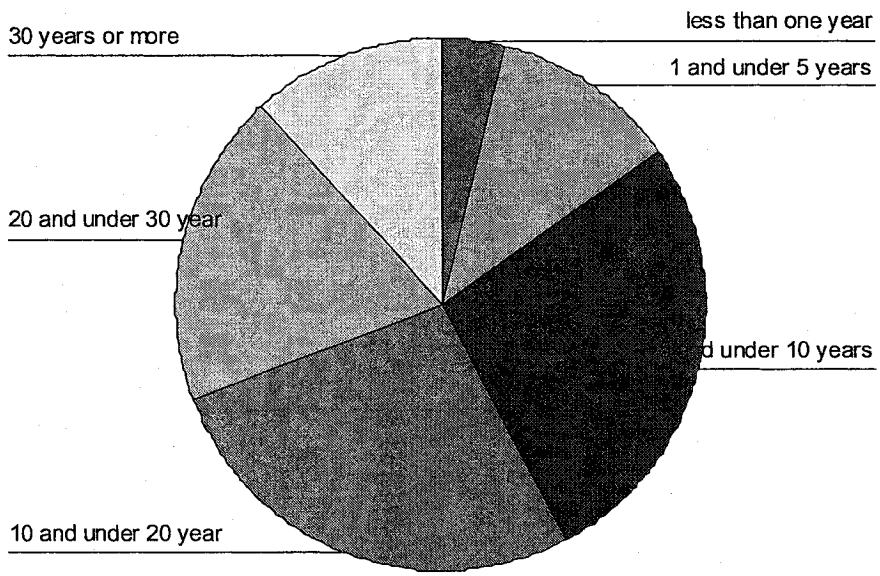
Number of Years in Current Teaching Position



In the area of total teaching experience (survey question 8), only four professors (15.3 %) had been teaching for less than five years. The largest percentages were found in the "5-9" and "10-19" year categories. Both of these categories consisted of 7 individuals (26.9 %) for a total of 53.8 % with "5-19" years of teaching experience. There were five (19.2 %) in the "20-29" category and only three (11.5 %) who had been teaching for over thirty years. Figure 4.4 shows the number of years of total teaching experience.

Figure 4.4

Number of Years Total Teaching Experience



Data Analysis

The second set of survey questions pertained to the integration of ethics in the general computer science curriculum. The specific database related questions appeared in the third section of the questionnaire.

Concerning the question on how ethics is taught in the undergraduate technical computer science courses (survey question 9), the data showed that 20 professors (76.9 %) indicated that computer ethics is integrated spontaneously in the technical courses. The senior seminar setting was selected by 10 individuals (38.5 %) and 11 respondents (42.3 %) mentioned a separate computer ethics course. Only 3.8 % of the professors

suggested that they utilized previously published guidelines concerning how to integrate ethics in the technical computer science courses. Two individuals (7.7 %) responded that they rarely discussed ethics in the computer science curriculum.

The next set of questions dealt with what teaching approaches have been most effective for teaching the ethics component. The following data is associated with survey question 10. The "Group Discussion" approach was selected most frequently at 92.3 %. Nine professors selected the "Lecture" method for a percentage of 34.6. The "Student Research / Presentation" approach was selected by 6 individuals representing 23.1 % of the group. The "Other" approach of teaching computer ethics was indicated by 3 individuals (11.5 %).

Concerning who teaches the ethics component, the survey results (question 11) indicate that all of the computer science professors participate in integrating ethics in the computer science curriculum. While 24 of the 26 respondents indicated that they were active in teaching the ethics component, two professors (7.7 %) used philosophy professors to assist with the integration process.

In the area of student evaluation (survey question 12), the professors selected "Group Interaction" most frequently with 14 people (53.8 %) selecting this option. The "Test" category was selected 13 times with a 50 % overall distribution. The "Writing Quality" option was selected by 10 individuals with a percentage of 38.5. Student evaluation based on "Presentations" was indicated by 9 professors (34.6 %). While the lowest category was "Other" at a frequency of 3 (11.5 %), it is interesting that the "catch all" option received over 10 %. Those who use the "Case Study" approach may have selected this category.

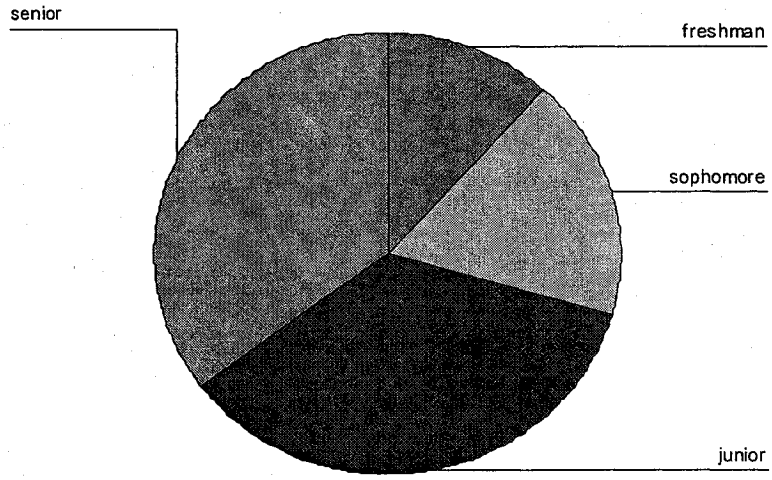
The next group of questions pertained to the discussion of ethical theories before examining specific moral cases in computer science. The frequency for the "Yes" response was 14 (56.0 %). In survey question 13, eleven professors (44.0 %) indicated that they do not discuss ethical theories in their computer science courses.

The next question (survey question 14) related to the need for an upper-level capstone Computer Ethics course even after the effective integration of ethics has been attained. The frequency for the "No" response was 17 (65.4 %). Nine of the professors (34.6 %) indicated that the upper-level capstone Computer Ethics course would still be needed.

Concerning the need for a required dedicated Computer Ethics course (survey question 15), 14 individuals (53.8 %) responded with a "Yes" and 12 professors (46.2 %) selected "No". Seventeen individuals selected one of the freshmen through senior options. Of the respondents who selected "Yes", two individuals (11.7 %) selected the freshman level. The sophomore level was selected by three people (17.6 %). Both the junior and senior levels received a frequency of six (35.2 %). Therefore, 70.5 % of the professors who indicated a need for a required dedicated Computer Ethics course selected the upper-level years. Figure 4.5 shows the proposed year for a computer ethics course.

Figure 4.5

Required Computer Ethics Course Year



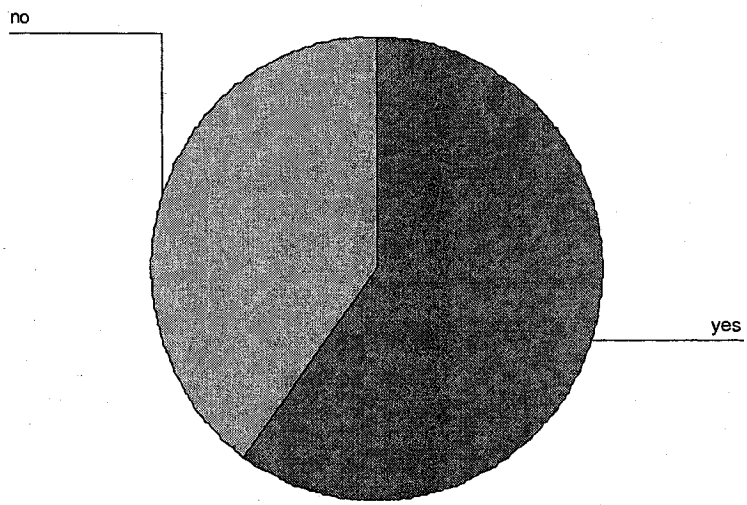
The following questions were specifically focused on the database course within the undergraduate computer science curriculum. In the ACM/IEEE curriculum model 2001 the database area was referred to as "Information Management" (IM). The following question (survey question 16) provided information regarding the distinction between those professors who teach the database course and those individuals who have not taught the database course. Those who have taught the database course answered the remaining questions based on what they have "actually covered" in the classroom. Those who have not taught the database course provided answers based on what they "would do" if they had the opportunity to teach the database course.

There were 15 professors who had taught the database course. This represented 60.0 % of the total. Ten individuals (40.0 %) had not taught the database course at the college level. One individual did not answer this question. The relative high percentages

in both categories allows for an effective comparison to be made between the professors who have taught the database course and those who have not had the opportunity to teach the information management component of the computer science curriculum. Figure 4.6 shows the distribution of the professors who have and have not taught the database course.

Figure 4.6

Taught / Not Taught Database Course



Questions 17 through 56 have a direct relationship with the integration of ethics into the database course. The first analysis was for the entire set of professors regardless of their teaching experience in the database area. After the overall analysis, the researcher reexamined the question with the objective of providing a variance between those professors who have taught the database course and the professors who have not taught the course. The following was provided to the professors on the survey questionnaire:

Table 4.1

Selection Options on Database Related Questions

Not Covered 1…..2…..3…..4…..5 Covered Extensively

For analysis purposes, the following categories are used:

- 1 Not covered
- 2 Somewhat not covered
- *1 or 2 Toward not covered*
- 3 Neutral
- 4 Somewhat covered
- 5 Covered extensively
- *4 or 5 Toward covered extensively*

Based on the hypothesis described in Chapter 3, the researcher initially expected responses for all database specific survey questions to be within the 1-2 range representing a low level of coverage. Initially, the researcher suggested that responses in the 4-5 range would represent an effective level of ethical integration in the database course. After the data analysis phase, the researcher changed the interpretation to consider any response below 3.0 to indicate a low level of coverage and responses 3.0 or greater to indicate a tendency toward effective integration. The researcher has observed that many people who complete survey questionnaires do not respond on either extreme (e.g. 1 or 5). The researcher was reminded of this phenomenon after reviewing the survey results and adjusted the data interpretation accordingly.

IM1: Information Models and Systems:

Concerning the overall principle of privacy (survey question 17), 12 professors (46.2 %) indicated the "Somewhat covered" category. Four individuals (15.4 %) suggested that they fall in the "Covered extensively" option. The remaining professors 8 selected neutral (30.8 %) and the "Toward not covered" categories were selected by two people (7.7 %). The majority of the professors indicated that they cover the concept of

privacy in the introductory sections of the course. Furthermore, a significant percentage (38.5 %) responded with a lukewarm response.

For those who had taught the database course (N = 15), the mean was 3.53 and the standard deviation produced a .915 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.90 and .738 respectively. The overall mean for (N = 25) was 3.68 with a .852 standard deviation. Table 4.2 summarizes the above data concerning privacy in a general context of databases.

Table 4.2

Privacy in a general context of databases

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
0	2	8	12	4
0.0%	7.7%	30.8%	46.2%	15.4%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.53	0.915
No	10	3.90	0.738
Overall	25	3.68	0.852

The concept of integrity (survey question 18) within the context of database technology pertains to the overall accuracy of the data that is managed by the database software. Most of the professors indicated that the issues of database integrity is important. One half of the professors selected the "Somewhat covered" category with an additional eight individuals (30.8 %) in the "Covered extensively" level of coverage. Four people were in the "Neutral" range and one individual (3.8 %) was in the "Toward not covered" level.

For those who had taught the database course (N = 15), the mean was 4.07 and the standard deviation produced a .704 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 4.10 and .994 respectively. The overall mean for (N = 25) was 4.08 with a .812 standard deviation. Table 4.3 illustrates the data concerning the concept of integrity within the IM1 module.

Table 4.3

The Concept of Integrity

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
0	1	4	13	8
0.0%	3.8%	15.4%	50.0%	30.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	4.07	0.704
No	10	4.10	0.994
Overall	25	4.08	0.812

Similar results were found in the question concerning the discussion of the issue of security (survey question 19) within the IM1 section of the database course. The "Somewhat covered" option was selected by 12 individuals (46.2 %) and the highest level of coverage was checked by eight professors (30.8 %).

For those who had taught the database course (N = 15), the mean was 3.73 and the standard deviation produced a .799 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 4.50 and .707 respectively. The overall mean for (N = 25) was 4.04 with a .841 standard deviation. The data summary for the issue of security appears in Table 4.4.

Table 4.4

The Issue of Security

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
0	1	5	12	8
0.0%	3.8%	19.2%	46.2%	30.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.73	0.799
No	10	4.50	0.707
Overall	25	4.04	0.841

The professors perceived the issue of information preservation (survey question 20) for future generations with less importance. Eleven individuals (42.3 %) selected the lesser coverage options. Seven professors (26.9 %) selected the "Somewhat covered" options and eight individuals (30.8 %) marked the "Covered extensively" column. Overall, 57.7 % of the professors indicated that they cover the issue of information preservation in an effective manner.

For those who had taught the database course (N = 15), the mean was 3.33 and the standard deviation produced a 1.047 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 4.30 and .949 respectively. The overall mean for (N = 25) was 3.72 with a 1.100 standard deviation. Table 4.5 provides an overview of the data associated with the issue of information preservation.

Table 4.5

The Issue of Information Preservation

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
0	4	7	7	8
0.0%	15.4%	26.9%	26.9%	30.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.33	1.047
No	10	4.30	0.949
Overall	25	3.72	1.100

While discussions concerning the importance of effective backup policies (survey question 21) are usually an important component of the database course, the ethical ramifications of such policies need to be included in the set of course content for the IM1 section. Only 5 professors (19.2 %) selected the covered extensively options for this question. The highest frequency was at the neutral level with 11 individuals (42.3 %). Ten professors (38.5) tended to lean toward the "Not covered" category.

For those who had taught the database course (N = 15), the mean was 2.13 and the standard deviation produced a .915 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.10 and .994 respectively. The overall mean for (N = 25) was 2.52 with a 1.046 standard deviation. Data associated with the ethical ramification of database backup policies appears in Table 4.6.

Table 4.6

The Ethical Ramification of Database Backup Policies

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
6	4	11	5	5
23.1%	15.4%	42.3%	19.2%	0.0%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.13	0.915
No	10	3.10	0.994
Overall	25	2.52	1.046

The issue of scalability (survey question 22) pertains to the effective upgrade of database technology to accommodate data growth without the burden of unnecessary costs and time. Most of the data for this question was skewed toward the "Not covered" category. Nineteen individuals (73.1 %) indicated that this issue was not a high priority in their classrooms. Five professors (19.2 %) took the middle of the road option. Only two (7.7 %) of the professors indicated that this notion was discussed in their classroom.

Most of the professors who have not covered this material were individuals who have taught the database course. Thirteen professors (50.0 %) who have taught the database course indicated that they do not cover this material in their database courses. From the set of professors who have not taught the database course, only 6 individuals (23.0 %) suggested that they would not cover this material in their database classrooms.

For those who had taught the database course (N = 15), the mean was 1.80 and the standard deviation produced a .676 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 2.40 and .843 respectively. The

overall mean for (N = 25) was 2.04 with a .790 standard deviation. Table 4.7 illustrates the results for the ethical issues relating to the importance of scalability.

Table 4.7

The Ethical Issues Relating to the Importance of Scalability

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
6	13	5	2	0
23.1%	50.0%	19.2%	7.7%	0.0%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	1.80	0.676
No	10	2.40	0.843
Overall	25	2.04	0.790

IM2: Database Systems:

Concerning the notion that database systems can be more ethical than flat-files (survey question 23), most of the professors selected answers that were on the "Not covered" end of the scale. Fourteen individuals (53.9 %) indicated that this issue was not a high priority in their classrooms. Seven professors (26.9 %) took the middle of the road option. Four professors (15.4 %) leaned toward covering the material extensively. Only one individual representing 3.8 % of the professor population indicated that this notion was discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.27 and the standard deviation produced a 1.335 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 2.40 and .966 respectively. The overall mean for (N = 25) was 2.32 with a 1.180 standard deviation. The above data

concerning the observation that database systems can be more ethical appears in Table 4.8.

Table 4.8

The Observation that Database Systems Can Be More Ethical

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
8	6	7	4	1
30.8%	23.1%	26.9%	15.4%	3.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.27	1.335
No	10	2.40	0.966
Overall	25	2.32	1.180

The next question (survey question 24) was concerned with how data duplication results in harm to users and technical people. Most of the professors selected answers that were on the "Not covered" end of the spectrum. Fourteen individuals (53.8 %) indicated that this issue was not a high priority in their classrooms. Four professors (15.4 %) took the middle of the road option. Eight (30.7 %) of the professors indicated that this notion was discussed or should be discussed extensively.

For those who had taught the database course (N = 15), the mean was 2.80 and the standard deviation produced a 1.424 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 2.60 and .966 respectively. The overall mean for (N = 25) was 2.72 with a 1.242 standard deviation. (see Table 4.9)

Table 4.9

How Data Duplication Results in Harm to Users and Technical People

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
3	11	4	5	3
11.5%	42.3%	15.4%	19.2%	11.5%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.80	1.424
No	10	2.60	0.966
Overall	25	2.72	1.242

The social impact of database technology (survey question 25) represents a very broad category. Seven individuals (26.9 %) indicated that this issue was not a high priority in their classrooms. Four professors (15.4 %) selected the neutral category for this question. Nine professors (34.6 %) leaned toward covering the material extensively. Six individuals representing 23.1 % of the professor population indicated that this notion should be or was discussed extensively. Therefore, over half of the professors suggested that the social impact of database technology is important to cover in this section of the information management course.

For those who had taught the database course (N = 15), the mean was 3.40 and the standard deviation produced a 1.352 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.60 and 1.075 respectively. The overall mean for (N = 25) was 3.48 with a 1.229 standard deviation. Table 4.10 shows the statistical analysis of the social impact of database technology data.

Table 4.10

The Social Impact of Database Technology

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	6	4	9	6
3.8%	23.1%	15.4%	34.6%	23.1%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.40	1.352
No	10	3.60	1.075
Overall	25	3.48	1.229

The issue of data independence (survey question 26) is a technical issue. A database environment allows programmers to define data structures outside the scope of individual programs. When data is described in computer programs, programmers are harmed when the database is changed. If an attribute is expanded from 5 characters to 9 and data independence is not utilized, all programs that use that attribute would have to be changed to accommodate the new database structure.

Most of the professors selected answers that were on the "Not covered" end of the scale. Fifteen individuals (57.7 %) indicated that this issue was not a high priority in their classrooms. Seven professors (26.9 %) gave a neutral response. Two professors (7.7 %) leaned toward covering the material extensively. Only two individuals representing 7.7 % of the professor population indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.07 and the standard deviation produced a 1.163 value. The mean and standard deviation for those

who had not taught the database course (N = 10) was 2.60 and 1.265 respectively. The overall mean for (N = 25) was 2.28 with a 1.208 standard deviation. Table 4.11 summarizes the data for this question.

Table 4.11

Ethical issues involving the concept of data independence

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
8	7	7	2	2
30.8%	26.9%	26.9%	7.7%	7.7%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.07	1.163
No	10	2.60	1.265
Overall	25	2.28	1.208

The next survey question (survey question 27) pertained to the ethical problems associated with using a powerful query language. A query language in the hands of an unethical person can not only be used as a tool to invade the privacy of individuals, but also can have built-in facilities to add, change, and delete user data.

Again, most of the professors selected answers that were on the "Not covered" end of the scale. Fifteen individuals (57.7 %) indicated that this issue was not a high priority in their classrooms. Six professors (23.1 %) gave a neutral response. Two professors (7.7 %) leaned toward covering the material extensively. Three individuals representing 11.5 % of the professor population indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.07 and the standard deviation produced a .961 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 2.90 and 1.595 respectively. The overall mean for (N = 25) was 2.40 with a 1.291 standard deviation. Table 4.12 provides a summary of the ethical problems associated with using a powerful query.

Table 4.12

The Ethical Problems Associated with Using a Powerful Query

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	6	4	9	6
3.8%	23.1%	15.4%	34.6%	23.1%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.07	0.961
No	10	2.90	1.595
Overall	25	2.40	1.291

IM3: Data Modeling

Concerning the consequences that arise from not doing an effective job with data modeling (survey question 28), there was an even distribution of answers for this question. Seven professors selected answers that were on the "Not covered" end of the scale. These seven individuals (26.9 %) indicated that this issue was not a high priority in their classrooms. Six professors (23.1 %) gave a neutral response. Eight professors (30.8 %) leaned toward covering the material extensively. Five individuals representing 19.2 % of the professor population indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 3.53 and the standard deviation produced a 1.356 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.10 and .876 respectively. The overall mean for (N = 25) was 3.36 with a 1.186 standard deviation. (see Table 4.13)

Table 4.13

Doing an Effective Job with Data Modeling

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	6	6	8	5
3.8%	23.1%	23.1%	30.8%	19.2%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.53	1.356
No	10	3.10	0.876
Overall	25	3.36	1.186

The data for the question that was involved with keeping current with the latest data modeling techniques (survey question 29) was skewed toward the not covered end of the scale. Fourteen professors (53.9 %) selected answers that were on the "Not covered" end of the scale. Only three professors (11.5 %) gave a neutral response. Eight professors (30.8 %) leaned toward covering the material extensively. Only one individual representing 3.8 % of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.27 and the standard deviation produced a 1.100 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.20 and 1.135 respectively. The

overall mean for (N = 25) was 2.64 with a 1.186 standard deviation. Table 4.14 presents the results for this area of ethical concern.

Table 4.14

The Importance of Keeping Current with Data Modeling

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
4	10	3	8	1
15.4%	38.5%	11.5%	30.8%	3.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.27	1.100
No	10	3.20	1.135
Overall	25	2.64	1.186

The next issue was related to how the utilization of the relational model can result in a higher level of integrity (survey question 30). The data for this question was more evenly distributed across the scale. Eight professors (30.8 %) selected answers that were on the "Not covered" end of the scale. Only four professors (15.4 %) gave a neutral response. Seven professors (26.9 %) leaned toward covering the material extensively. Seven individuals representing 26.9 % of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom. A majority of those professors who indicated that they include this material had taught the database course.

For those who had taught the database course (N = 15), the mean was 3.80 and the standard deviation produced a 1.146 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.00 and 1.247 respectively. The

overall mean for (N = 25) was 3.48 with a 1.229 standard deviation. Table 4.15 illustrates the above data.

Table 4.15

The Utilization of the Relational Model Can Result In Integrity

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
0	8	4	7	7
0.0%	30.8%	15.4%	26.9%	26.9%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.80	1.146
No	10	3.00	1.247
Overall	25	3.48	1.229

Concerning the relationship of responsibility to the process of data modeling (survey question 31), the data for this question was skewed to the less covered end of the scale. Nine professors (34.6 %) selected answers that were on the "Not covered" end of the scale. Seven professors (26.9 %) gave a neutral response. Seven professors (26.9 %) leaned toward covering the material extensively. Three individuals representing 11.5 % of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 3.20 and the standard deviation produced a 1.082 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.00 and 1.054 respectively. The overall mean for (N = 25) was 3.12 with a 1.054 standard deviation. Table 4.16 shows the data for this survey question.

Table 4.16

The Relationship of Responsibility to the Process of Data Modeling

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
0	9	7	7	3
0.0%	34.6%	26.9%	26.9%	11.5%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.20	1.082
No	10	3.00	1.054
Overall	25	3.12	1.054

IM4: Relational Databases

In contrast to the previous question, the data for this item involving why an effective relational schema is important (survey question 32) was skewed to the covered extensively section of the scale. Only one professor (3.8 %) selected the "Not covered" option. Seven professors (26.9 %) indicated the "Toward not covered" category on the scale. Only one professor (3.8 %) gave a neutral response. Seven professors (26.9 %) leaned toward covering the material extensively. Ten individuals (38.5 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 3.93 and the standard deviation produced a 1.163 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.20 and 1.549 respectively. The overall mean for (N = 25) was 3.64 with a 1.350 standard deviation. (see Table 4.17)

Table 4.17

Why an Effective Relational Schema is Important

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	7	1	7	10
3.8%	26.9%	3.8%	26.9%	38.5%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.93	1.163
No	10	3.20	1.549
Overall	25	3.64	1.350

The application of relational algebra reduces the complexity of a database structure. This more concise format is more ethical because of a reduction in harm for future maintenance of the supporting programs.

The data for this item (survey question 33) was skewed more toward the not covered end of the scale. Five professors (19.2 %) selected the "Not covered" option. Nine professors (34.6 %) indicated the "Toward not covered" category on the scale. Five professors (19.2 %) gave a neutral response. Only 5 professors (19.2 %) leaned toward covering the material extensively. Two individuals (7.7 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.67 and the standard deviation produced a 1.291 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 2.40 and 1.174 respectively. The overall mean for (N = 25) was 2.56 with a 1.227 standard deviation. (see Table 4.18)

Table 4.18

Application of Relational Algebra

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	7	1	7	10
3.8%	26.9%	3.8%	26.9%	38.5%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.93	1.163
No	10	3.20	1.549
Overall	25	3.64	1.350

IM5: Database Query Languages

Surprisingly, the data for this item involving the ethical concerns associated with query language update statements (survey question 34) was skewed more toward the not covered end of the scale. Six professors (23.1 %) selected the "Not covered" option. Eight professors (30.8 %) indicated the "Toward not covered" category on the scale. Six professors (23.1 %) gave a neutral response. Four professors (15.4 %) leaned toward covering the material extensively. Only two individuals (7.7 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.40 and the standard deviation produced a 1.404 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 2.60 and .966 respectively. The overall mean for (N = 25) was 2.48 with a 1.229 standard deviation. Table 4.19 shows the frequencies and other statistics for this survey question.

Table 4.19

The Ethical Concerns Associated with Query Language Updates

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
6	8	6	4	2
23.1%	30.8%	23.1%	15.4%	7.7%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.40	1.404
No	10	2.60	0.966
Overall	25	2.48	1.229

The next question (survey question 35) related to the ethical issues surrounding the concept of audit trails. In a more evenly distribution of frequencies, the professors provided data across the scale. One professor (3.8 %) selected the "Not covered" option. Seven professors (26.9 %) indicated the "Toward not covered" category on the scale. Six professors (23.1 %) gave a neutral response. Seven professors (26.9 %) leaned toward covering the material extensively. Five individuals (19.2 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 3.07 and the standard deviation produced a 1.163 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.60 and 1.265 respectively. The overall mean for (N = 25) was 3.28 with a 1.208 standard deviation. (see Table 4.20)

Table 4.20

The Ethical Issues Surrounding the Concept of Audit Trails

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	7	6	7	5
3.8%	26.9%	23.1%	26.9%	19.2%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.07	1.163
No	10	3.60	1.265
Overall	25	3.28	1.208

In a similar distribution of frequencies as was found in the preceding question, the professors provided data across the scale when asked about the relationship between database accuracy and query language updates (survey question 36). Four professors (15.4 %) selected the "Not covered" option. Seven professors (26.9 %) indicated the "Toward not covered" category on the scale. Four professors (15.4 %) gave a neutral response. Eight professors (30.8 %) leaned toward covering the material extensively. Three individuals (11.5 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.87 and the standard deviation produced a 1.356 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.00 and 1.333 respectively. The overall mean for (N = 25) was 2.92 with a 1.320 standard deviation. (see Table 4.21)

Table 4.21

Database Accuracy and Query Language Updates

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
4	7	4	8	3
7.8%	13.7%	7.8%	15.7%	5.9%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.87	1.356
No	10	3.00	1.333
Overall	25	2.92	1.320

The data for this item (survey question 37) involving how database queries relate to the issue of information privacy was skewed to the covered extensively section of the scale. Only 1 professor (3.8 %) selected the "Not covered" option. Only four professors (15.4 %) indicated the "Toward not covered" category on the scale. Seven professors (26.9 %) gave a neutral response. Six professors (23.1 %) leaned toward covering the material extensively. Eight individuals (30.8 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 3.67 and the standard deviation produced a 1.175 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.50 and 1.354 respectively. The overall mean for (N = 25) was 3.60 with a 1.225 standard deviation. (see Table 4.22)

Table 4.22

How Database Queries Relate to Information Privacy

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	4	7	6	8
3.8%	15.4%	26.9%	23.1%	30.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.67	1.175
No	10	3.50	1.354
Overall	25	3.60	1.225

Concerning the role of the database administrator in addressing SQL-related ethical issues (survey question 38), five professors (19.2 %) selected the "Not covered" option. Five professors (19.2 %) indicated the "Toward not covered" category on the scale. Five professors (19.2 %) gave a neutral response. Seven professors (26.9 %) indicated that they tend to/would cover the material extensively. Four individuals (15.4 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom. Most of the professors who indicated that they do not include this material in their database classrooms where from the set of individuals who mentioned that they had taught the database course.

For those who had taught the database course (N = 15), the mean was 2.73 and the standard deviation produced a 1.534 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.20 and 1.033 respectively. The overall mean for (N = 25) was 2.92 with a 1.352 standard deviation. Table 4.23 provides a summary of the findings regarding this issue.

Table 4.23

The Role of the Database Administrator in SQL Ethical Issues

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
5	5	5	7	4
19.2%	19.2%	19.2%	26.9%	15.4%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.73	1.534
No	10	3.20	1.033
Overall	25	2.92	1.352

IM6: Relational database design

Surprisingly, the data for this item (survey question 39) concerning the ethics involving the use of normal forms for an effective database design was skewed definitely toward the not covered end of the scale. Ten professors (38.5 %) selected the "Not covered" option. Four professors (15.4 %) indicated the "Toward not covered" category on the scale. Six professors (23.1 %) gave a neutral response. Only five professors (19.2 %) leaned toward covering the material extensively. Just one individual (3.8 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom. The amount of harm generated from not utilizing normal form technology is extensive for both uses and technical people. The use of normal forms reduces inaccuracies, eliminates data duplication, and makes the database structure much simpler.

For those who had taught the database course (N = 15), the mean was 2.40 and the standard deviation produced a 1.404 value. The mean and standard deviation for those

who had not taught the database course (N = 10) was 2.10 and 1.101 respectively. The overall mean for (N = 25) was 2.28 with a 1.275 standard deviation. (see Table 4.24)

Table 4.24

The Ethics Involving the Use of Normal Forms for Effective Database Design

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
10	4	6	5	1
38.5%	15.4%	23.1%	19.2%	3.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.40	1.404
No	10	2.10	1.101
Overall	25	2.28	1.275

The data for the next item (survey question 40) concerning how an ineffective database design could result in harm, a lack of integrity, and stress was skewed toward the "Covered extensively" section of the scale. Only one professor (3.8 %) selected the "Not covered" option. Only four professors (15.4 %) indicated the "Toward not covered" category on the scale. Seven professors (26.9 %) gave a neutral response. Eight professors (30.8 %) leaned toward covering the material extensively. Six individuals (23.1 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom. The amount of harm generated from not utilizing normal form technology is extensive for both uses and technical people. The use of normal forms reduces inaccuracies, eliminates data duplication, and makes the database structure much simpler.

For those who had taught the database course (N = 15), the mean was 3.73 and the standard deviation produced a 1.100 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.20 and 1.229 respectively. The overall mean for (N = 25) was 3.52 with a 1.159 standard deviation. (see Table 4.25)

Table 4.25

Ineffective Database Design

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	4	7	8	6
3.8%	15.4%	26.9%	30.8%	23.1%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.73	1.100
No	10	3.20	1.229
Overall	25	3.52	1.159

IM7: Transaction processing

The topic of mutual exclusion is usually presented in a technical context. The ethical dimensions arise when examining the implications of not utilizing record locking techniques. While the data for this item (survey question 41) was skewed toward the covered end of the scale, the neutral category received a large frequency. Five professors (19.2 %) selected the "Not covered" option. Only one professor (3.8 %) indicated the "Toward not covered" category on the scale. Four professors (15.4 %) gave a neutral response. Six individuals (23.1 %) leaned toward covering the material extensively. An impressive ten individuals (38.5 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 3.87 and the standard deviation produced a 1.356 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.00 and 1.700 respectively. The overall mean for (N = 25) was 3.52 with a 1.531 standard deviation. (see Table 4.26)

Table 4.26

The Importance of Mutual Exclusion with Transaction Records

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
5	1	4	6	10
19.2%	3.8%	15.4%	23.1%	38.5%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.87	1.356
No	10	3.00	1.700
Overall	25	3.52	1.531

The next question (survey question 42) addressed ethical issues related to sensitive information like social security numbers and credit cards. Since privacy is viewed as the primary ethical issue surrounding database technology, it is not surprising that the responses of this question were weighted on the "Covered extensively" edge of the scale. One professor (3.8 %) selected the "Not covered" option. Only one professor (3.8 %) indicated the "Toward not covered" category on the scale. It is surprising that five professors (19.2 %) gave a neutral response. Eight individuals (30.8 %) leaned toward covering the material extensively. Eleven individuals (42.3 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 3.93 and the standard deviation produced a .961 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 4.10 and 1.287 respectively. The overall mean for (N = 25) was 4.00 with a 1.080 standard deviation. (see Table 4.27)

Table 4.27

Sensitive Information

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
1	1	5	8	11
3.8%	3.8%	19.2%	30.8%	42.3%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.93	0.961
No	10	4.10	1.287
Overall	25	4.00	1.080

The depersonalizing topic (survey question 43) is usually not presented in the database course. It is interesting that the majority of the people who responded selected the neutral category. Two professors (7.7 %) selected the "Not covered" option. Only four professors (15.4 %) indicated the "Toward not covered" category on the scale. Twelve professors (46.2 %) gave a neutral response. Four individuals (15.4 %) leaned toward covering the material extensively. Only four individuals (15.4 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.93 and the standard deviation produced a 1.223 value. The mean and standard deviation for those

who had not taught the database course (N = 10) was 3.40 and .966 respectively. The overall mean for (N = 25) was 3.12 with a 1.130 standard deviation. Table 4.28 illustrates the depersonalizing data.

Table 4.28

The Concept of Depersonalizing Transaction Records

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
2	4	12	4	4
7.7%	15.4%	46.2%	15.4%	15.4%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.93	1.223
No	10	3.40	0.966
Overall	25	3.12	1.130

IM8: Distributed databases

The data for the question concerning properly committing a transaction to databases stored on multiple nodes (survey question 44) was skewed to some extent toward the "Not covered" categories. Six professors (23.1 %) selected the "Not covered" option. Five professors (19.2 %) indicated the "Toward not covered" category on the scale. Only four professors (15.4 %) gave a neutral response. Five individuals (19.2 %) leaned toward covering the material extensively. Six individuals (23.1 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.93 and the standard deviation produced a 1.624 value. The mean and standard deviation for those

who had not taught the database course (N = 10) was 3.00 and 1.491 respectively. The overall mean for (N = 25) was 2.96 with a 1.541 standard deviation. (see Table 4.29)

Table 4.29

Properly Committing a Transaction to Multiple Nodes Databases

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
6	5	4	5	6
23.1%	19.2%	15.4%	19.2%	23.1%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.93	1.624
No	10	3.00	1.491
Overall	25	2.96	1.541

The next question (survey question 45) related to having a proper level of security in a distributed database environment. The data showed a nearly even split between the not covered and covered extensively categories. Seven professors (26.9 %) selected the "Not covered" option. This is a large number for the "Not covered" option. Only one professor (3.8 %) indicated the "Toward not covered" category on the scale. Three professors (11.5 %) gave a neutral response. Eight individuals (30.8 %) leaned toward covering the material extensively. Seven individuals (26.9 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom. The data indicates that 57.7 % of the professors see distributed security as an important topic for discussion in the database course.

For those who had taught the database course (N = 15), the mean was 3.00 and the standard deviation produced a 1.648 value. The mean and standard deviation for those

who had not taught the database course (N = 10) was 3.60 and 1.578 respectively. The overall mean for (N = 25) was 3.24 with a 1.615 standard deviation. (see Table 4.30)

Table 4.30

Security in a Distributed Database Environment

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
7	1	3	8	7
26.9%	3.8%	15.4%	30.8%	26.9%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.00	1.648
No	10	3.60	1.578
Overall	25	3.24	1.615

IM9: Physical database design

For the question involving the effect of algorithms and data structures on integrity (survey question 46), the data was skewed on the "Not covered" side of the scale. Five professors (19.2 %) selected the "Not covered" option. Seven professors (26.9 %) indicated the "Toward not covered" category on the scale. Furthermore, seven professors (26.9 %) gave a neutral response. Only four individuals (15.4 %) leaned toward covering the material extensively. Only three individuals (11.5 %) of the professor population who responded indicated that this notion was/should be discussed extensively in their classroom. The data suggests that over seventy % of the professors who responded do not see a connection between ethics and the core computer science study of algorithms and data structures.

For those who had taught the database course (N = 15), the mean was 2.67 and the standard deviation produced a 1.175 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 2.70 and 1.494 respectively. The overall mean for (N = 25) was 2.68 with a 1.282 standard deviation. When cross-tabulation occurs between this question and the discipline of their highest degree, only those professors with degrees in computer science selected in the "covered" end of the scale. Seven professors (26.9 %) with computer science degrees selected the 4-5 range. There were zero 4-5 categories selected by those professors with their degree in some other field. Table 4.31 provides a summary for the above data.

Table 4.31

The Effect of Algorithms and Data Structures on Integrity

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
5	7	7	4	3
19.2%	26.9%	26.9%	15.4%	11.5%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.67	1.175
No	10	2.70	1.494
Overall	25	2.68	1.282

IM10: Data mining

For the question pertaining to the ethical dimensions that are associated with data mining (survey question 47), the data is evenly distributed across the scale. Five professors (19.2 %) selected the "Not covered" option. Additionally, five professors (19.2 %) indicated the "Toward not covered" category on the scale. Furthermore, four

professors (15.4 %) gave a neutral response to the question. Four individuals (15.4 %) leaned toward covering the material extensively. There were eight individuals (30.8 %) who responded indicated that this notion was/should be discussed extensively in their classroom. The data suggest that over fifty % of the professors do not cover the ethical issues surrounding data mining in their database courses.

For those who had taught the database course (N = 15), the mean was 2.60 and the standard deviation produced a 1.549 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 4.00 and 1.247 respectively. The overall mean for (N = 25) was 3.16 with a 1.573 standard deviation. (see Table 4.32)

Table 4.32

The Ethical Dimensions that are Associated with Data Mining

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
5	5	4	4	8
19.2%	19.2%	15.4%	15.4%	30.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.60	1.549
No	10	4.00	1.247
Overall	25	3.16	1.573

Concerning the relationship between privacy and data mining (survey question 48), the data is evenly distributed across the scale in a very similar manner as the previous question. Five professors (19.2 %) selected the "Not covered" option. Four professors (15.4 %) indicated the "Toward not covered" category on the scale. Only three professors (11.5 %) gave a neutral response to the question. Five individuals (19.2

%) leaned toward covering the material extensively. There were nine individuals (34.6 %) who responded that indicated that this notion was/should be discussed extensively in their classroom. Again, the data suggest that nearly fifty % of the professors do not cover the ethical issues surrounding data mining in their database courses.

For those who had taught the database course (N = 15), the mean was 2.73 and the standard deviation produced a 1.624 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 4.20 and 1.135 respectively. The overall mean for (N = 25) was 3.32 with a 1.600 standard deviation. (see Table 4.33)

Table 4.33

Privacy and Data Mining

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
5	4	3	5	9
19.2%	15.4%	11.5%	19.2%	34.6%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.73	1.624
No	10	4.20	1.135
Overall	25	3.32	1.600

For the question relating to the unethical selling of customer information (survey question 49), the data is skewed toward the "Covered extensively" side of the scale. Only three professors (11.5 %) selected the "Not covered" option. Furthermore, three professors (11.5 %) indicated the "Toward not covered" category on the scale. Only one professor (3.8 %) gave a neutral response to the question. As one moves to the "Covered more extensively" section of the scale, nine individuals (34.6 %) leaned toward covering

the material extensively. There were 10 individuals (38.5 %) who responded that indicated this notion was/should be discussed extensively in their classroom. The data suggest that over seventy % of the professors do cover the ethical issues surrounding the unethical selling of customer information.

For those who had taught the database course (N = 15), the mean was 3.40 and the standard deviation produced a 1.549 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 4.20 and 1.033 respectively. The overall mean for (N = 25) was 3.72 with a 1.400 standard deviation. (see Table 4.34)

Table 4.34

The Unethical Selling of Customer Information

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
3	3	1	9	10
11.5%	11.5%	3.8%	34.6%	38.5%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.40	1.549
No	10	4.20	1.033
Overall	25	3.72	1.400

IM11: Information storage and retrieval

The concept of the invisibility factor first appeared in Moor's 1985 paper. It relates to the hidden aspects within the detailed logic of computer programs. For this question (survey question 50), the data is skewed toward the "Not covered" category. Six professors (23.1 %) selected the "Not covered" option. Furthermore, eight professors (30.8 %) indicated the "Toward not covered" category on the scale. Four professors

(15.4 %) gave a neutral response to the question. Six individuals (23.1 %) leaned toward covering the material extensively. Only two of the individuals (7.7 %) who responded indicated that this notion was/should be discussed extensively in their classroom. The data suggest that over fifty % of the professors do not cover the ethical issues surrounding the ethical issues that emerge from invisibility factor.

For those who had taught the database course (N = 15), the mean was 2.13 and the standard deviation produced a 1.302 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.20 and 1.033 respectively. The overall mean for (N = 25) was 2.56 with a 1.294 standard deviation. The data suggests that 11 out of the 15 professors (73.3 %) who indicated that they have taught the database course did not cover the ethical issues surrounding the "invisibility factor" in their courses. The professors who had not taught the database course placed a higher priority on the ethical dimensions of the invisibility factor notion. (see Table 4.35)

Table 4.35

The Various "Invisibility factor" Issues such as Search Engine Bias

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
6	8	4	6	2
23.1%	30.8%	15.4%	23.1%	7.7%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.13	1.302
No	10	3.20	1.033
Overall	25	2.56	1.294

RAID technology has been used for many years to increase the hardware reliability of database storage technology. The use of RAID technology has a strong relationship with database integrity. For the question concerning the importance of using such technology as RAID to prevent loss of information (survey question 51), the data is evenly distributed across the various categories. Four professors (15.4 %) selected the "Not covered" option. Six professors (23.1 %) indicated the "Toward not covered" category on the scale. Only five professors (19.2 %) gave a neutral response to the question. Seven individuals (26.9 %) leaned toward covering the material extensively. Four of the individuals (15.4 %) who responded indicated that this notion was/should be discussed extensively in their classroom. While this topic usually is discussed in the computer architecture course, the ethical issues associated with RAID technology can be included in an effective database course.

For those who had taught the database course (N = 15), the mean was 3.00 and the standard deviation produced a 1.464 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.00 and 1.247 respectively. The overall mean for (N = 25) was 3.00 with a 1.354 standard deviation. (see Table 4.36)

Table 4.36

The Importance of Using Such Technology as RAID

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
4	6	5	7	4
15.4%	23.1%	19.2%	26.9%	15.4%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	3.00	1.464
No	10	3.00	1.247
Overall	25	3.00	1.354

IM12: Hypertext and hypermedia

Information presentation is often associated with "front end" applications that format and present database information in a graphical user interface (GUI) environment. It is important to understand the ethical and cultural aspects of the user-interface design. For the question involving the ethical issues that are related to information presentation (survey question 52), the data falls primarily in the "Not covered" categories. Six professors (23.1 %) selected the "Not covered" option. Seven professors (26.9 %) checked the "Toward not covered" category on the scale. Four professors (15.4 %) gave a neutral response to the question. Six individuals (23.1 %) leaned toward covering the material extensively. Only three of the individuals (11.5 %) who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.40 and the standard deviation produced a 1.454 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.10 and 1.197 respectively. The

overall mean for (N = 25) was 2.68 with a 1.376 standard deviation. Table 4.37 summarizes the above set of data.

Table 4.37

The Ethical Issues that are Related to Information Presentation

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
6	7	4	6	3
23.1%	26.9%	15.4%	23.1%	11.5%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.40	1.454
No	10	3.10	1.197
Overall	25	2.68	1.376

IM13: Multimedia information and systems

Concerning the appropriate use of multimedia presentation (survey question 53), the data is evenly distributed across the various categories. Eleven professors (42.3 %) selected the "Not covered" option. Four professors (15.4 %) indicated the "Toward not covered" category on the scale. Only two professors (7.7 %) gave a neutral response to the question. Eight individuals (30.8 %) leaned toward covering the material extensively. Only one of the individuals (3.8 %) who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.07 and the standard deviation produced a 1.335 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 2.70 and 1.494 respectively. The overall mean for (N = 25) was 2.32 with a 1.406 standard deviation.

The data suggests that six out of the 15 professors (40.0 %) who indicated that they have taught the database course did not cover the ethical issues surrounding the "invisibility factor" in their courses. The professors who had not taught the database course placed a higher priority on this ethical dimension of information management. (see Table 4.38)

Table 4.38

Multimedia Presentation

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
11	4	2	8	1
42.3%	15.4%	7.7%	30.8%	3.8%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.07	1.335
No	10	2.70	1.494
Overall	25	2.32	1.406

IM14: Digital libraries

For the question concerning the issue of intellectual property rights within the context of digital libraries (survey question 54), the data appears most frequently in the neutral and extensively covered categories. Four professors (15.4 %) selected the "Not covered" option. Three professors (11.5 %) indicated the "Toward not covered" category on the scale. Eight professors (30.8 %) gave a neutral response to the question. Six individuals (23.1 %) leaned toward covering the material extensively. Five of the individuals (19.2 %) who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.87 and the standard deviation produced a 1.506 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.60 and .966 respectively. The overall mean for (N = 25) was 3.16 with a 1.344 standard deviation. (see Table 4.39)

Table 4.39

The Issue of Property Rights within Digital Libraries

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
4	3	8	6	5
15.4%	11.5%	30.8%	23.1%	19.2%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.87	1.506
No	10	3.60	0.966
Overall	25	3.16	1.344

For the question pertaining to the ethical concerns surrounding archiving and preservation for digital libraries (survey question 55), the data appears most frequently in the neutral and extensively covered categories. Eight professors (30.8 %) selected the "Not covered" option. Three professors (11.5 %) indicated the "Toward not covered" category on the scale. Six professors (23.1 %) gave a neutral response to the question. Five individuals (19.2 %) leaned toward covering the material extensively. Four of the individuals (15.4 %) who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.27 and the standard deviation produced a 1.580 value. The mean and standard deviation for those

who had not taught the database course (N = 10) was 3.40 and 1.075 respectively. The overall mean for (N = 25) was 2.72 with a 1.487 standard deviation. (see Table 4.40)

Table 4.40

The Ethical Concerns Surrounding Archiving and Preservation

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
8	3	6	5	4
30.8%	11.5%	23.1%	19.2%	15.4%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.27	1.508
No	10	3.40	1.075
Overall	25	2.72	1.487

Concerning the issue of integrity and accuracy of information stored in a digital library (survey question 56), the data appears evenly distributed. Six professors (23.1 %) selected the "Not covered" option. Four professors (15.4 %) indicated the "Toward not covered" category on the scale. Additionally, four professors (15.4 %) gave a neutral response to the question. Seven individuals (26.9 %) leaned toward covering the material extensively. Five of the individuals (19.2 %) who responded indicated that this notion was/should be discussed extensively in their classroom.

For those who had taught the database course (N = 15), the mean was 2.60 and the standard deviation produced a 1.639 value. The mean and standard deviation for those who had not taught the database course (N = 10) was 3.60 and 1.075 respectively. The overall mean for (N = 25) was 3.00 with a 1.500 standard deviation. Table 4.41 provides a summary of the above set of data.

Table 4.41

The Integrity and Accuracy of Data Stored in a Digital Library

(1) Not Covered	(2) Somewhat Not Covered	(3) Neutral	(4) Somewhat Covered	(5) Covered
6	4	4	7	5
23.1%	15.4%	15.4%	26.9%	19.2%

Taught Database	Professors	Mean	Standard Deviation
Yes	15	2.60	1.639
No	10	3.60	1.075
Overall	25	3.00	1.500

This chapter provided a summary of the results that emerged from the statistical analysis of the survey data. The researcher presented results that show the distinction between those professors who had taught the database course and the educators who had not taught the database course. This data and associated results appear in Chapter 5 to generate recommendations for the effective integration of ethics into the database course. These recommendations have a direct relationship with the IEEE/ACM curricula model for the information management (IM) area and have been grounded in a solid natural law theory of ethics.

Chapter 5: Discussion and Conclusion

This chapter provides a set of baseline data to increase professor awareness and provide direction for the effective integration of ethics into the database course, the centerpiece of the computer science curriculum at the undergraduate level. The chapter concludes with a section entitled "justification in ethical theory" and finally provides future directions for additional research. The researcher's proposal for a greater level of integration of ethics throughout the computer science course of study, especially the database course, will increase student awareness of the issues that are so important in their field. In turn, this awareness will allow the students to make more effective ethical decisions (good choices) in the future.

Interpretation of Results

With a set of ethical issues along with their philosophical support, the researcher will provide a detailed set of suggestions for the effective integration of ethical issues into the database course. The researcher used the results of the literature review and survey of professors to prepare recommendations for teaching a database course in a Christian or other liberal arts college. The recommendations contain specifics concerning how to integrate the ethical issues along with the technical material of the database course.

The justification of ethical recommendations needs to be grounded in an ethical theory that can be accepted by people across the spectrum of personal worldviews. The researcher has selected natural law as the primary ethical theory for moral decision-making. While the author's conception of natural law is within a Christian worldview framework, the concept of natural law for human kind is universal and can be accepted by individuals regardless of worldview preferences. The premise is that the natural law

structure provides a facility for knowing the principles of right and wrong regardless of religious and cultural dimensions. This consistency across the human boundaries of difference is what makes natural law an effective foundation for the study of ethics within the realm of computer science. (See Appendices F and G for an in-depth discussion of natural law.)

The information management (IM) section of the ACM/IEEE computer science curriculum model 2001 provides a framework for the development of an educational guide for the effective integration of ethics into the database course. The researcher will enhance each of the 14 segments of the information management area with suggested topics revolving around the ethical components that have a relationship with the technical material.

Research questions 1-9, pertaining to the integration of ethics in computer science in general, have a direct relationship to the survey of computer science professors and relate to the broad area of teaching computer ethics. Research questions 8-10 involve a comparison of the professor responses with the literature review, codes of ethics, and the author's professional experience. The ethical issues within the context of the specific database course were addressed in the forty sub-questions that are associated with research question 11. Each of these specific questions has a direct relationship to a particular section of the database course as described in the ACM/IEEE 2001 standard.

The Information Management (IM) section of the ACM/IEEE model curriculum 2001 for computer science provides a framework for teaching the database course. The curriculum model structures the various database content into fourteen modules that cover topics ranging from design through such high-level applications as digital libraries.

Furthermore, the model is independent of any particular database textbook. Each module within the model contains a list of topics and associated learning objectives.

The goal of this chapter is to develop recommendations for the future development of a comprehensive curriculum model for the effective integration of ethics in the database course. The proposed curricula recommendations enhance the 2001 model and are based on the data analysis obtained in chapter four. The review of the literature, ACM/AITP codes of ethics, and the researcher's industry and teaching experience provided input into the design and development of the computer science professor survey. The results were derived from a statistical analysis of the computer science professor survey data. Various issues for each of the fourteen modules are discussed within a theory of ethics based on the natural law concept.

The researcher examined the issues addressed in the literature review, codes of ethics, and author's experience in light of the particular module in the course. The professor survey statistics revealed the current level of coverage of specific information management ethical issues for those professors who have taught the database course. Additionally, the level of importance placed on each survey question from those individuals who have not taught the database course were considered. With this information, the researcher recommends specific suggestions for the effective integration of ethics into the particular modules of the Information Management (IM) section of the ACM/IEEE 2001 standard.

There were several limitations observed during the survey process that make it necessary to clarify or qualify the results. These limitations provide opportunities for additional research (see ***Future Directions*** at the end of Chapter 5).

General Computer Ethics Information

The statistics indicate that computer ethics is integrated spontaneously without utilizing any previously published guidelines concerning how to integrate ethics in the technical computer science courses. Most of the professors indicated that the "Group Discussion" approach for teaching the ethics component was most effective. The "Student Research / Presentation" method was utilized to some extent but not at the level expected by the researcher. Regardless, the group discussion approach to teaching computer ethics allows students to develop their own thoughts concerning the various situations and cases that can arise within the context of computing.

Concerning the necessity of an upper-level capstone Computer Ethics course, the data analysis suggested that there are differences of opinion in this area of computer science curriculum development. In question nine, less than half (42.3 %) of the professors indicated that they utilize a separate Computer Ethics course. Question 14 revealed that most of the professors would prefer to not have an upper-level capstone Computer Ethics course after an effective level of integration of ethics in the computer science curriculum has been achieved. Nearly 35 % of the professors still suggested that a separate Computer Ethics course would continue to be needed. Of the individuals who selected a freshman through senior option in question 15, a large percentage (70.5 %) selected the junior and senior years.

Over half (56 %) of the professors indicated that they discuss ethical theories before presenting detailed moral issues. However, 44 % indicated that they do not discuss ethical theories in their computer science classrooms. The extent of coverage of ethical theories was not obtained from this study. As the integration of ethics becomes

more widespread in the computing community, the number of professors who understand and discuss ethical theories should increase to provide effective instruction.

The data suggests that the computer science professors handle the ethical component without help from other disciplines. Since most of their graduate studies were in the technical areas, many of the professors have little formal education in philosophy and ethics. This researcher strongly recommends that computer science professors attend courses or workshops in ethics and consult with their colleagues in philosophy or business ethics as part of a proactive approach to become more effective with the integration of ethics in their computer science courses. The computer science professors need to become more proficient in understanding the various theories of ethics that provide a footing for moral decision-making at the technical level.

The area of student evaluation represents another segment of teaching computer ethics that needs further consideration. While the group interaction approach and tests were selected by over half of the professors in the survey, the student presentation option has a lower frequency. The presentation category should have been higher since students learn material well when their research is summarized in a classroom presentation. Additionally, test questions need to be written in a way that allows students to connect their moral decision-making to their own ethical theory or worldview. This represents a challenge for computer science professors and further supports the need for additional instructor education in ethics. While student evaluation is important, the development of effective goals and objectives for the ethical component within the database course will help reduce the difficulties inherent to student evaluation.

Specific Database Course Information

Concerning any variance between the set of ethical issues as identified by the literature review and what computer science professors teach in the database course, the survey results indicated some important differences. In the researcher's opinion, some areas are covered and other issues are not covered at an acceptable level. The survey data indicated that computer science professors do not integrate ethics at an effective level. The means for professors who indicated that they have taught the database course show that only 35 % of the detailed database issues included in the survey instrument were effectively covered by these individuals. Sixty-five % of these issues that have a close connection to the technical content of the database course were not covered to an expected level. While major issues such as privacy are covered, many of the other issues are not discussed in the database classroom.

information models and systems [IM1]

The first module within the Information Management (IM) section of the ACM/IEEE 2001 model curriculum was labeled "Information Models and Systems." The first learning objective pertains to the distinction between data and information. When comparing and contrasting data and information, it is important to emphasize the notion of being correct. Integrity is important for both raw data and information. For data, the ethical dimension begins with decisions regarding what data is needed and continues through the data collection, input, editing, and internal database structure. This data acquisition phase of information management represents the foundation for system reliability.

Furthermore, information integrity is not only based on effective data acquisition, but additionally depends on internal data structure and software reliability. The issue of integrity was the most often referred to topic in the review of the computer ethics literature. The survey results showed that the topic of integrity is covered effectively in the IM1 section of the database course.

The second learning objective in the IM1 area related to historical aspects of information systems and the future potential of information storage and retrieval. The concept of privacy, along with other major ethical issues, needs to be addressed in a very broad way to introduce students to some of the major moral topics that are associated with database technology.

The statistical analysis of the survey results indicates that a greater emphasis needs to be placed on the topic of integrity at this point in the database course. The professors who had not taught the course placed a higher level of importance on the topic of privacy in IM1 than those individuals who have experience teaching the database course. The literature review contained a large number of references to the concept of privacy. The professional codes of ethics placed privacy under the headings of "honoring confidentiality and respecting privacy" and "obligations to society." Overall, the professors who completed the survey were leaning toward the "covered extensively" categories, but were not consistent in the way they responded.

The third IM1 objective related to how well database applications satisfy user needs. Users should not only expect excellence, but also demand it from technical people. The ethics component has to do with the harm that is generated from ineffective

database systems. This harm extends beyond users to the technical people who are responsible for future maintenance activities on the system.

The ethical issues of integrity, responsibility, and quality of life have a relationship to such technical issues as proper testing, exception handling, and the engineering question of "How good is good enough?"

The fourth learning objective in IM1 addressed four ethical issues that are associated with database technology in general. While the issues of privacy, integrity, security, and preservation are listed, there are no guidelines that place them within the context of the specific technical aspects of database technology. While the issue of security is more of a solution than an ethical concern, it continues to be heavily addressed in the computer ethics literature. The survey statistics indicate a sufficient level of coverage of the security topic in the database classroom. The issue of information preservation was considered very important by the professors who had not taught the database course. The professors who had taught the database course responded within the neutral range when asked about their level of coverage involving the topic of information preservation at this point in the course. It is good to get the students familiar with the topic of information preservation early in the database course since the selection of database management systems has an impact on the future usability of data.

Another IM1 specific-level objective mentioned the issues of measuring efficiency and effectiveness. In contrast to discussing these in a stand-alone manner, it is best to relate these measurements to specific techniques that have emerged throughout the history of modern database processing.

The issue of scalability from small to global applications was included in another learning objective. The survey statistics show very little coverage of this topic during this early stage of the database course. It would be unethical for a company to purchase a database product that fails to meet the user's needs as business growth occurs.

Another general issue not mentioned in the IM1 guidelines relates to the ethical ramifications associated with database backup policies. Harm can be inflicted on all parties when backup and recovery procedures are ineffective. Sound backup policies and off site storage procedures must be implemented and periodically tested.

This section of the database course is more general than many of the remaining modules. While not an exhaustive list, the issues of protection of children's information, security, password sharing, policy vacuums, whistle blowing, property rights, professionalism, continuing education, avoiding harm and accountability can be integrated into lesson plans at the beginning of the course.

database systems [IM2]

Concerning the observation that database systems can be more ethical than flat-files, the survey results showed a lack of coverage by both the computer science professors who have taught the database course and those who have not taught the course. The first learning objective in IM2 has to do with distinguishing the database approach from the traditional utilization of data files.

Applications built around flat-file technology have a lack of program-data independence and do not provide the flexibility to change the data structure in an efficient manner. With a flat-file system, the addition of a single attribute or a change to the format of an existing attribute results in modifications to all programs that utilize those

files. There is a lack of data independence since the record structures for each file used are coded within each application program. This results in harm to the programmers who must search throughout a system for references to a particular file and to the end users who have to wait longer and pay more. Simple modifications to the structure of data within a flat-file system can result in a major programming project that in turn helps to deteriorate the overall reliability of the system.

In contrast, data independence is inherent to modern database management systems. The structure of attributes can be changed and new information fields added without having to change every program that opens the table. In a database system, changes occur only in those programs that use that particular attribute. There is less application program maintenance in a database management system. Additionally, there is less data duplication in database systems. This attempt to eliminate data duplication results in a higher level of data integrity. The fifth objective in this section addresses the issues of data independence. In addition to the technical advantages associated with database systems, computer science professors need to address the ethical advantages that are characteristic to the utilization of modern database environments. The computer science professor survey data showed that most of the professors who completed the survey and teach the database course do not cover the concept of duplication to a large extent in this IM2 section. Concerning the ethical issues associated with data independence, the professor survey revealed that the professors do not cover this topic at this early stage of the course.

The second objective in the IM2 section pertains to large set of database issues including basic goals, functions, models, components, and applications. Along with these

technical topics, the issue of social impact is included. Again, the curriculum model places the social impact issue in a stand-alone setting within the context of very broad topics. In the survey, both the professors who have taught the course and those who have not taught the course responded in the neutral range with a slight preference for covering the material to a greater extent. The best way to address the social impact of database technology is to identify particular ethical issues that relate to specific database technical topics.

The next two learning objectives in the model deal with describing basic components and functions of modern database products. Likewise, this objective pertains to some very general topics. This would be an opportune time to introduce in a very general way some of the techniques such as the concept of mutual exclusion that can be discussed in detail later in the course.

The last specific-level objectives in this IM2 section focuses on the use a high-level query languages to elicit information from a database. This objective addresses the general purpose and function of query languages such as SQL with a focus on the technical aspects. After describing the general purpose of a powerful query language, the instructor should talk about some of the ethical issues that intersect with the query language topic. The discussion would definitely include the topics of security, privacy, responsibility, and integrity. The privacy concerns relate to the distribution of information produced by query language processes and the integrity issue becomes evident when an awareness sets in that many query languages have update capabilities and can add, change, and delete information. Furthermore, query languages can change the database structure such as the addition of new attributes and the reformatting of

existing attributes. The survey statistics indicate that the ethical concerns associated with query languages are not addressed at this stage in the computer science database classroom.

data modeling [IM3]

All of the learning objectives within the IM3 section relate to the concept of data modeling. Data modeling techniques include analysis and initial design tools that are utilized by database professionals in the construction of an effective model before the actual design and implementation of the database system. The relationship of ethics to data modeling is initially hidden and emerges later during the actualization of the model. The time spent during the initial data-modeling phase has a direct relationship to the overall quality of the product. Many of the ethical issues that can emerge and remain problematic in modern database environments are minimized as the quality of a database increases. There is an inverse relationship between unethical actions and the level of excellence as exemplified by the quality of a particular database design.

Concerning the consequences that arise from not doing an effective job with data modeling, the professor survey statistics show a middle of the road response from both groups of computer science educators. While the emphasis has been on the technical aspects of various methodologies such as entity-relationship diagrams, computer science professors need to mention to the students that there are ethical consequences associated with the early phases of database development.

As new methodologies emerge in the database field, it becomes important to keep current with the latest data modeling techniques. The professors who have teaching experience in the database area indicated in the survey that they do not cover how

keeping current has an ethical dimension. The survey results indicated that the professors who have not taught the database course rated this area in the neutral range. This was nearly a full point higher on the 5-point scale.

In the IM3 module the instructor introduces the relational model to students. During the comparison of file-processing systems with database management environments, most professors discuss how many of the problems associated with the traditional approach are solved by the database solution. These problems are usually presented in the light of a technical discussion. The professors who have taught the database course mentioned on the survey that they tend to cover how the relational model results in a higher level of integrity. The professors who had not taught the course responded neutrally to this question.

The last survey question in the IM3 section pertained to the relationship of responsibility to the process of data modeling. It is the responsibility of the technical people to understand the consequences associated with the selection of database methods. The ethical issue of responsibility is important throughout the range of activities associated with the database profession. The survey statistics show that the professors who have taught the course cover this material to some degree but not extensively. The group who had not taught the database course did not consider the issue of responsibility as extremely important at this point in the database course. Several additional ethical issues can be included in this section of the database course. These issues include what information to collect, user consent, peer review, disclosure of system limitations, conflicts of interest, user feedback, policy vacuums, and excellence. While section IM3

introduced the topic of relational databases, the next module provides an exclusive focus on this popular model.

relational databases [IM4]

The development of an effective database begins with a schema that describes the various tables, proposed attributes, and relationships. Unlike traditional file processing systems, database environments have less duplication, a higher level of integrity, and allow sufficient security measures to protect the data from unethical situations.

The first survey question in this module related to why an effective relational schema is important. The survey results show that the professors consider this topic to be important and those professors who have taught the database course have covered this aspect in their classrooms. The professors who had not taught the database course responded in the neutral range. The basic idea is that an effectively designed database is more ethical since an ineffective database design is more open to unethical actions.

The last survey question for the IM4 section involved how relational algebra can result in a higher level of database integrity. Relational algebra is used to reduce the complexity of database queries with the generation of simpler sections of code that are functionally equivalent to the more complex version. Anytime complexity is reduced, a product becomes easier to understand and maintain. There is an inverse relationship between program complexity and software reliability. The overall integrity of a database environment is higher when simple solutions are actively sought after. A mid-range neutral response was obtained from the survey. While the professors do not cover this material extensively, they are aware of the place of relational algebra within the overall scheme of database technology. Computer science professors should mention the

interaction between ethics and technology when discussing the utilization of relational algebra in database design.

database query languages [IM5]

The most popular query language is Structured Query Language (SQL). SQL has been the dominant database query language since the 1970s. While the language has been standardized, both minor and major variations exist in the computing industry. Oracle's PL-SQL is an example of the latter. The PL-SQL language has enhanced capabilities due to the addition of a full-function c++ like language to the standard database query mechanisms.

The basic function of a query language is to provide an interface between the user and the data stored within a database management system. This interaction includes the query data manipulation language (DML) functions that provide selection, projection, search, sort, and output format operations. The ethical issues related to the pure query function involve the adequacy of security, privacy, data theft, responsibility, and integrity.

Additionally, the SQL data manipulation functionality provides a means to update data stored in database environments. The commands include operations for adding, changing, and deleting user data. The same SQL that allows data to be extracted from database storage can be utilized for metadata purposes. Metadata is data stored within a database that is used to describe user data. Data definition language (DDL) SQL commands modify the structure of the database. The DDL commands are used to create new tables, establish relations between tables, add new attributes, change attribute characteristics, and remove attributes from a database table.

While in the wrong hands these data definition language (DDL) commands can cause havoc for a database administrator. Most of the ethical issues emerge out of the query facility since most database administrators have sufficient protection and security to prevent unauthorized access to commands that can change the database structure. Since database administrators consider the pure query applications as not being as harmful, they place less security measures on that facet of the query language. Even simple queries without any update function can be used unethically in a variety of ways. For example, proprietary information can be obtained before changing jobs. This type of activity not only harms one's employer but also can violate individual privacy.

SQL is not a complex programming language. It is relatively easy to learn how to do simple queries of database data. Additionally, this "ease of use" factor can contribute to the technology being used in unethical ways. Computer science educators must emphasize the ethical component of query languages since such technologies as SQL provides a direct interface to data contained in and protected by modern database management systems.

The computer science professor survey results show that while the technical aspects of SQL are a key component of database courses, the ethical issues associated with query languages could be covered more effectively in the database classroom. The means for both those professors who have taught the database course and those who have not taught the course were below the neutral range. Due to the powerful nature of query languages, ease of use, and widespread use, the ethical topics associated with this important aspect of database technology must be covered concurrently with the presentation of the technical aspects. As our students become future database

administrators, it is hoped that they will remember the ethical dimension and strive to protect user data to the greatest extent possible.

Many database management systems can provide audit trails for data that has been changed in database environments. These audit trails are an important retardant to unethical actions. While not covered extensively, the professors in the survey selected a neutral range within the scale from not covered to covered extensively. The audit trail topic is usually presented in the context of backup and recovery. While it is vital for data and program recovery, the subtle notion of audit trails being used to reduce unethical behavior is a topic worth discussing with college students.

Another survey question relating to IM5 pertained to the relationship between database accuracy and query language update procedures. Overall, the survey statistics illustrated that most of the professors did not cover or did not consider this an important topic of discussion. This topic relates to the database integrity issue, proper security, and professional responsibility. While much SQL code is embedded in application programs, it is important to remember that without sufficient security, SQL statements can be entered from the command line prompt and inflict significant damage on the database assets.

The idea of responsibility directs our thoughts to the administrative and technical personnel that manage the daily operations of the database environment. The notion of being responsible is an ethical issue. Those individuals who are not responsible for their actions have an unethical influence on others. The principle of responsibility is built on character, virtue, continuing education, excellence, and professionalism. The professors who had taught the database course responded in the "not covered" range of the scale.

The professors who had not taught the database course considered this topic a little more important with an overall neutral mean.

Furthermore, the issues of not misrepresenting information, embezzlement, changes in information content, access to information, believability, and piracy have a place in lesson plans for this important section of the database course.

relational database design [IM6]

The process of database normalization is a systematic methodology to generate effective tables from the initial schema designs. The normalization process reduces data duplication by providing connection fields. Given an invoice, the customer number should be the only customer related attribute associated with the particular invoice record. The customer number becomes the "connection field" to customer name, address, and other customer information stored in the main customer table.

If the customer name is stored in the invoice record, duplication occurs with the name attribute stored in multiple locations. Furthermore, the integrity of the database is degraded when one instance of the attribute is changed and the other(s) retain their previous values.

The true potential of a relational database can only be realized when an efficient normalization process has been completed before the development and implementation of the database environment. With an effective design made possible by the normalization process, the post-implementation (maintenance) phase becomes less problematic and the system becomes a more ethical tool for the benefit of human kind.

The researcher observed from the survey statistics that the professors did not fully understand the importance of the ethics involving the use of normal forms for an effective

database design. Both groups of computer science professors indicated that they do place a high priority on discussing the ethics associated with normal forms in the database classroom. First through fourth normal forms (1NF – 4NF) take time and require good examples to teach effectively. Fifth normal form remains a difficult concept to discuss without a very clear case where 5NF makes a difference in the design. Since this is such a challenging subject for students to grasp, instructors focus on the technical aspects in order to attain a higher level of student proficiency. While technical proficiency is important, computer science professors need to spark student discussions concerning the moral responsibilities associated with the normal form technique.

The final IM6 survey question reiterated the importance of including the ethics dimension in this section of the database course. The comment, "an ineffective database design could result in harm, a lack of integrity, and stress" was responded to by the professors. This broad statement received higher marks with the professors who have taught the course leaning toward the "covered extensively" portion of the scale. This data reinforces the notion that computer science professors include general statements involving ethics in their database courses but invoke less thought concerning the relationship of ethical issues to specific technical material.

In addition to the above material, several related issues pertain to relational database design. These issues include peer reviews, effort to minimize malfunctions, the acceptance of user feedback, and ownership of design ideas.

transaction processing [IM7]

Transaction processing is an important area of database technology. Transactions represent such events as customer orders, payroll time sheets, purchase orders, inventory

movement, and general ledger adjustments. In contrast to permanent data such as the customer master table, transactions have a shorter life span and on the average contain less data per record. Transactions are used to update other tables and can later be deleted or saved in history files. Detailed sales history data provides an important input to decision support, forecasting systems and data mining. Since transactions are a major source of input and output to a database system, an understanding of the ethical issues surrounding transaction processing is extremely important.

One of the technical principles not always built into a database environment is mutual exclusion. In the PICK database environment, the version of BASIC used a READU statement to lock a record before updating. In the PICK environment, the programmer must explicitly lock records when updating to maintain the integrity of the write statement. With mutual exclusion, the system will not let another process update a record that is currently locked. Mutual exclusion ensures that all concurrent updates are made correctly. The ethical dimensions arise when examining the implications of not utilizing record locking techniques.

The survey statistics reveal that the professors who have taught the database course cover the importance of mutual exclusion in their courses. The sample who had not taught the database course responded in the neutral range for the mutual exclusion topic. The topic of mutual exclusion is traditionally taught in a technical context with the focus of instruction directed toward semaphores and other techniques for implementing mutual exclusion. Many professors see mutual exclusion as being transparent to the programmer. While this is true in many database systems, the concept of mutual exclusion has an important impact on database integrity.

With regard to ethical issues related to sensitive information like social security numbers and credit cards, the survey results suggested that the professors cover this privacy issue effectively in their database courses. The professors who have not had a chance to teach the database course placed a high priority on this issue.

Additionally the professors responded in the neutral range involving the concept of depersonalizing transaction records. Depersonalizing transaction records pertains to removing sensitive data from records before they are sent offsite for statistical or other processing. With depersonalization, the privacy of customers, suppliers, employees, and others is maintained. Computer science professors should include the topic of depersonalization when discussing the technical aspects of transaction processing.

A recent development in the area of maintaining a high level of integrity in transaction processing systems relates to section 404 of the Sarbanes-Oxley Act. With this act, computer and manual processes are subject to controls and audits so systems can maintain a high level of reliability. The programming techniques associated with exception handling was included in the review of the literature and is important in the transaction processing area because when software handles problems the integrity of the database increases and the level of harm to all involved decreases.

distributed databases [IM8]

The centralized computer rooms during the early period of computing and today in large companies are secure since all data and equipment is at one central location. The servers within our client-server environments resemble the central mainframe in that both data and application software are stored at a single central location. Many applications require data to be distributed on local database environments throughout the global

playing field of business. The primary problem with distributed databases has to do with keeping physically separated data current in an ever-changing environment. The technology must allow distributed queries and transactions that are committed across databases stored on multiple nodes. A node represents a single location within the database network. Large database management systems have special administrative tools for maintaining an effective database on a global scale. The learning objectives for the IM8 module pertain to the technical aspects of distributed database environments.

The ethical issues that apply to centralized database environments are magnified in a distributed system. With a distributed system, the database administrator is physically removed from the locations where data resides. Proper security must be maintained at the remote locations and the integrity of the local database needs to be a high priority for database administrators. Furthermore, computer science professors need to include the ethical issues associated with distributed database environments when discussing the major technological features of distributed environments. Concerning the ethical issues associated with properly committing a transaction to databases stored on multiple nodes, the professors responded in the neutral part of the not covered/covered scale. Both groups of professors responded in a very similar manner. These professors discuss the technical aspects of distributed databases but only occasionally focus on the ethical concerns that are brought about by the distance factor.

In the area of having a proper level of security in a distributed database environment, the professors were in the neutral range. The professors who had taught the database course responded at the mid-point and the other group considered the topic of security in distributed systems as being more important with a mean at the upper end of

the neutral range. Computer science professors should be aware of the special moral concerns that emerge from having data distributed at distant locations. The deployment of Microsoft's Window Terminal Services takes the industry back to a more centralized computing environment where all programs and data reside on a single server and user interfaces are sent via the Internet to remote terminals. A greater level of control and security can be placed in this type of centralized environment.

physical database design [IM9]

The core of a database management system contains algorithms and data structures that implement the higher-level directives that are characteristic of such languages as SQL. Various data structures are established when tables are created and relations are setup. Temporary data structures are dynamically created when queries sort and combine data from multiple tables. Internal algorithms are used to select, sort, and represent data deep within the core of the database engine. The efficiency and reliability of these programs have a direct relationship to the overall integrity of the database. The ethical issues are related to software integrity, data integrity, programmer responsibility, the use of proper programming methodologies, and effective testing when changes occur. It is always a good idea to reduce complexity when possible and look for simple solutions first. When correct, simple solutions are easier to maintain and results in a more ethical database system.

When asked about the effect of algorithms and data structures on integrity, the professors indicated that they do not cover the ethical dimension of this material in their classrooms. The ethical issues associated with algorithms and data structures are not pure

database topics, but should be included in all programming courses at the undergraduate level.

data mining [IM10]

The concept of data mining emerged from the notion of saving transactions in history files for further processing. The issues of privacy, human dignity, informed consent, and depersonalization of records should affect data mining decisions. While data mining can be used exclusively for internal purposes, many times data is sold for marketing activities.

In responding to the teaching of the ethical dimensions that are associated with data mining, the professors who had taught the database course responded in the "not covered" area of the scale. It is interesting that those professors who had not taught the database course indicated that this issue is extremely important and that they would cover the ethical dimension if they taught the database course. The topic of data mining is mentioned in database courses but not discussed extensively. Perhaps this is why the professors who had taught the course gave this question such a low rating.

The same variance between professors who had taught the database course and those who had not appears in the next survey question. The question pertained to the relationship between privacy and data mining. The mean for the first group of professors who had taught the course was below the neutral category. These professors did not cover the ethical issues associated with data mining. The mean for the "have not taught" group responded with a "covered extensively" option that places a high priority on this issue. This trend was reversed in the area of unethical selling of customer information. The "have taught it" group responded with a solid neutral range and the other group

indicated that they would cover this topic if they had a chance to teach the database course. While this is one particular case within the data-mining arena, the results suggest that computer science professors need to become more effective in including related ethical issues with technical material.

Since this is a general area, there is a variety of ethical issues that could be discussed within the context of data mining. A subset of these issues include retention decisions, responsibility of technical people regarding user data, information filtering, dataveillance, identity theft, transmission of confidential data, and a practice called data fusion where multiple databases are utilized to invade the privacy of individuals.

information storage and retrieval [IM11]

While this area is dominated by very technical material, the ethical dimension becomes evident as the topic is examined more thoroughly. The material in this section of the database course ranges from detailed algorithms and data structures to the power of high-level Internet search engines.

The various "invisibility factor" issues such as search engine bias was included on the professor survey questionnaire. This issue, first brought to light by Moor in 1985, relates to the hidden aspects within the detailed logic of computer programs. It is possible that search engines have built-in code that directs individuals to pre-selected products and services. The issues of fairness and trust become important considerations in such technical environments. The statistics point to a lack of coverage of the topics associated with the "invisibility factor" in the database classroom. Those professors who have not taught the database course placed this topic within the neutral range of the possible options. It is evident that computer science professors need to relate various

experiences and case studies from this ethical angle. Computer science students must understand the ethical aspects from both a programmer and user perspective.

A technology referred to as Redundant Array of Inexpensive Disks (RAID) is used to shelter users from secondary storage failures. With RAID, the database is stored on multiple disk drives that is seen by the operating system as a single unit. Parity bits are generated from the data that allows lost information to be restructured when some of the disk drives fail. This increases the level of fault tolerance and performance increases due to the striping of data across the multiple disk drives.

It is more ethical to use such techniques as RAID because users experience less hardware downtime. Users and programmers are harmed when storage systems fail. When RAID is not utilized, data and programs must be restored from backup tapes and all updates to the database have to be performed again. Database integrity is increased with the use of RAID technologies. Both groups of computer science professors responded in the neutral range for this question. This indicates that the ethical issues associated with such technologies as RAID are not included in the database classrooms. It is important to remember that any technology that has the potential to improve the integrity of the database has an ethical dimension.

The literature review and examination of the professional codes of ethics reveal additional issues related to storage and retrieval. The issues of safety-critical systems, effort to minimize malfunctions, retention, destruction of computer data, obsolescence of data, and stewardship are among the moral particulars that can be integrated at this point in the database course.

hypertext and hypermedia [IM12] and multimedia information and systems [IM13]

The hypertext and hypermedia [IM12] and multimedia information and systems [IM13] modules have been combined due to their close relationship. As the area of human-computer interaction advanced, information presentation was transformed from simple text based user interfaces to more complex hypertext and hypermedia based in Internet Web protocols. The user-interface component of computer programming was separated from the application code and made easier by the use of object-orientated and graphical software tools. When designing and developing graphical user interface (GUI) environments, it is important to understand the ethical and cultural aspects of human-computer interaction.

The professors who participated in the survey were asked to consider the ethical issues that are related to information presentation. The professors who had taught the database course tended to agree that they do not cover the issues related to information presentation. The data from the "have not taught the database course" group revealed a neutral position on this item. The ethical issues associated with hypertext and hypermedia range from difficulty of use to the extent of understanding one has regarding cultural differences for the target user groups. Certain interface components that are not offensive in one culture may inflict harm in another social group. Database technicians need to evaluate user interface performance under certain Internet connection choices to provide alternatives for those individuals who have slower Internet connectivity speeds.

Concerning the appropriate use of multimedia presentations, both survey professor groups obtained a mean that was in the "not covered" end of the scale. Computer science professors need to develop examples and discuss the ethical issues that

are inherent to the sections of the database course that pertain to user-interface design and output format.

The previous two sections share a set of ethical issues. Most of these issues relate to the area of human-computer interaction. These issues include interface bias, search engine fairness, Section 508 of the ADA act, applications for the disabled, diversity, equal opportunity, the distance factor associated with the Internet, and gender issues.

digital libraries [IM14]

The digital revolution along with advances in database technology has affected all aspects of human civilization including the library that represents one of our oldest institutions. Digital libraries allow electronic searching and retrieving of information including full text from all forms of media including scholarly journals and books. While material can be downloaded and printed, the original publication remains at the digital library.

The issues of intellectual property rights, concerns surrounding archiving and preservation of digital material, and information accuracy represent some the ethical issues that standout within the realm of digital libraries. Concerning the ethical issues revolving around the concept of intellectual property, the professors who have taught the database course were in the "not covered" area. The other group of professors indicated a higher priority (high neutral) for this item. The professors who have not taught the database course recognized the importance of including this material in the database course while the professors who are teaching the course are more focused on the technical aspects of building indexes and storage. Intellectual property is a highly debated issue and needs to be addressed at this point in the database course.

Additionally, there was another variance in the two professor groups regarding the issue of archiving and preservation. The professors who have not taught the database course suggested that they would cover this material to a larger extent than the professors who have taught the database course. The complex technical nature of digital libraries leads professors to focus entirely on the technical details of the digital library database application. The statistics present similar results for the issue of integrity and accuracy of digital library information. While this is an absolute necessity in any digital library, the professors who teach this material do not include the ethical issues revolving around the concept of integrity at a sufficient level at this point in the course. Again, the professors who have not had the opportunity to teach the database course responded with a full point higher on the 5-point scale. This showed that our computer science educators consider the issues of accuracy and information integrity important in the digital library arena.

The digital library area of database technology is a broader application than a set of specific technical material. While the issues are very general, they are appropriate to include in a digital library lesson plan. Some of the issues are copyrights, license agreements, plagiarism, preservation of information for future generations, property rights, equality, acquisitions, equivalence of product, student integrity, contribution to society, human rights, quality of life, and human flourishing. Digital libraries are worth more than the sum of their technical parts. Digital libraries have a potential to advance civilization and place education on a more even footing throughout the world. These issues along with many others have a direct relationship to the technical material that describes the construction of such technical wonders. Computer science professors need

to address these issues and increase student awareness of the broader scope of their technical field.

An examination of the survey question structure reveals two groups: technical and ethical. While all were designed with a focus on ethical implications, some questions were worded in a way that seemed to place a higher emphasis on the technical material than the ethical dimension. The observation that the technical topics received higher scores (mean 3.281) than the ethical questions (mean 2.685) supports the thesis that the ethical dimension of database issues are not covered as thoroughly as the researcher believes they should. Table 5.1 illustrates the tendency toward higher scores on the technical side in contrast to the ethical-related survey questions.

Table 5.1

Technical and Ethical Question Analysis

--- Technical ---		--- Ethical ---	
Question	Taught=Y mean	Question	Taught=Y mean
18	4.07	17	3.53
19	3.73	21	2.13
20	3.33	22	1.80
28	3.53	23	2.27
29	2.27	24	2.80
30	3.80	25	3.40
32	3.93	26	2.07
33	3.93	27	2.07
36	2.87	31	3.20
37	3.67	34	2.40
40	3.73	35	3.07
41	3.87	38	2.73
44	2.93	39	2.40
45	3.00	42	3.93
46	2.67	43	2.93
50	2.13	47	2.60
51	3.00	48	2.73
56	2.60	49	3.40
	====	52	2.40
	3.281	53	2.07
		54	2.87
		55	2.27
			====
			2.685

The 0.6 mean variance between the two groups and the observation that most of the technical questions have a mean within the (3) range and a majority of the ethical items are in the (2) range supports the general conclusion that a better job needs to be done in the area of integrating ethics into the database course.

The overall results of this study indicate that computer science professors need to place additional emphasis on integrating ethics in their database classrooms. The data analysis did not support the null hypothesis that the professors effectively integrate ethics in their database courses and meet the other course objectives. Overall, this research

suggests that additional work is needed in the area of providing an effective level of integrating ethics in the computer science database course. The ethical issues that have been identified within the context of the database course are not unique to this specific aspect of computer science but have been magnified by technology. The ramifications of such issues as integrity, privacy, responsibility, quality of life, harm, and security extend beyond the database course to affect not only computer science but also all aspects of human endeavors.

Justification in Ethical Theory

For certainty to exist in moral decision-making, ethical principles must be grounded in something stable and enduring. One approach to stability that has emerged out of our intellectual tradition is a concept called natural law. This framework provides an unchanging and timeless footing for the development of an effective virtue ethics theory for our technological world.

The foundation for right and wrong is not created from human experience, it emerges from such experiences. The laws of ethics are *a priori* in that they reside outside of human experience. They remain constant throughout the universe in terms of both space and time. These laws apply not only to human kind but also to any being where reason reigns superior to instinct. The universal laws of morality are parallel to the natural laws of the physical universe. Like the physical laws of science, our awareness of these first-principles is made possible through our rational nature.

It is easier for a human being to grasp right from wrong than to understand the complex workings of the vast universe. The latter requires the application of the scientific method which the former only requires the use of reason. While we do not

always follow our inner awareness, this capability to know right from wrong facilitates our social nature.

The concept of natural law appears throughout human civilization from the time of ancient Greece. Aristotle (trans. 1941) referred to the notion of natural justice as being eternal and unchanging. Aquinas labeled this same concept "natural law" and placed it within the context of Christianity. Aquinas discussed how human beings use reason to participate in and gain insights into the Eternal Law of God where the purest form of knowledge exists.

Stone (2001) mentioned that during the eighteenth century, John Wesley argued for a right to human freedom from slavery from a natural law perspective (p. 26). C.S. Lewis (1944/2001) used the term "Tao" to describe the natural law concept. In a discussion involving the shaping of a Christian worldview, Dochery and Thornbury (2002) suggested that foundational convictions "serve as the bedrock support for our moral norms. You cannot dig any deeper than such convictions" (p. 113). In natural law theory, our foundational convictions are based not only on Biblical revelation or other religious readings, but also on that portion of natural law that pertains to human beings.

In support of a discovered natural law, Budziszewski (2003) maintained that, "If morality is created, not discovered, then surely different groups and individuals will create different moralities, for they will "care most" about different things" (pp. 6-7). Budziszewski continued, "But there is a common moral ground. Certain moral truths are common to all human beings" (p. 9). His thoughts were summarized with the comment, "Certain moral principles are not only right for all, but at some level known to all" (p. 15). The essential connection between natural law theory and computer ethics is that

natural law can provide a deontological framework for technical-related moral decision-making.

One of the best explanations of natural law is found in the writings of C. S. Lewis. In discussing harmony with Nature among diverse people, Lewis (1944/2001) referred to "the doctrine of objective value, the belief that certain attributes are really true and others are really false, to the kind of thing the universe is and the kind of things we are" (p. 18). Lewis labeled what is known to all men by reason as the "Tao." While acknowledging the difficult nature of proving the *Tao* argument, Lewis provided numerous examples of common ethical thinking among populations diverse in both location and time. Robert Wilkinson mentioned in the introduction to the *Tao te ching* (Tzu, trans. 1968) that the term "Tao" represents "the way or path" and is a short step to a "set of principles" in ancient Chinese philosophy. After recognizing the need "for some other ground even more 'basic' and 'realistic'" than human reason, Lewis turned this thoughts to the concept of natural law (p. 30). Lewis (1944/2001) continued with the following remarks (pp. 43-44):

> This thing which I have called for convenience *Tao*, and which others may call Natural Law or Traditional Morality or the First Principles of Practical Reason or the First Platitudes, is not one among a series of possible systems of value. It is the sole source of all value judgments. If it is rejected, all value is rejected. If any value is retained, it is retained. The effort to refute it and raise a new system of value in its place is self-contradictory. There never has been, and never will be, a radically new judgment of value in the history of the world. What purports to be new systems or (as they now call them) "ideologies," all consist of

> fragments from the *Tao* itself, arbitrarily wrenched from their context in the whole and then swollen to madness in their isolation, yet still owing to the *Tao* and to it alone such validity as they possess.

In support of the natural law approach, Lewis provided a list of "independent testimonies" from diverse cultures throughout human history. The notions from various populations were organized under the headings of eight major subsections (Lewis, 1944/2001, pp. 83-101). These major headings were:

Table 5.2

C.S. Lewis's Major Ethical Categories

1. The Law of General Beneficence
2. The Law of Special Beneficence
3. Duties to Parents, Elders, and Ancestors
4. Duties to Children and Posterity
5. The Law of Justice
6. The Law of Good Faith and Veracity
7. The Law of Mercy
8. The Law of Magnanimity

It is interesting that this list reminds one of Aristotle's virtues, the Ten Commandants, the teaching of Christ, and many other customs found in diverse populations throughout the world. The fact that these headings apply so easily within the context of humanity supports the universality of natural law. Computer science professors are not excluded from participation in natural law. The principles found in

natural law should form the basis for an effective level of integrating ethics into the database area of computer science.

Future Directions

In this section, the researcher discusses various ideas for additional database ethics research. These recommendations will assist future researchers with the next steps in the continuous journey towards understanding and being morally considerate in the technological future that lies ahead during this early period of the twenty-first century.

While an ethical emphasis was placed on the entire survey questionnaire, some questions seemed to place a higher emphasis on the technical content in contrast to the ethical implications. The analysis of the technical / ethical questions at the end of Chapter 5 illustrated that the technical questions received higher responses. Some computer science professors who had not taught the database course did not complete the survey. This provides an opportunity for continuing research with a separate questionnaire for those professors who had not taught the database course. While the distinction between the professors who had taught the database course and those individuals who had not was appropriate for this study, the responses from the latter group primarily provide a measurement of beliefs rather than what the educators would actually do given the constraints of time and technical objectives. While of interest, this data from the professors who had not taught the database course does not reflect the challenge of balancing the addition of the ethical content with the task of adequately covering the technical material required in the course.

The researcher did not record which colleges were represented in the data and those colleges were not included. This information could have provided additional

insights into the meaning of the overall results. Additional research could be conducted in this area. Furthermore, the researcher did not provide a common yardstick for respondents to use when answering the survey questions. While this yardstick could have been based on such items as minutes of class time, amount of homework, number of test questions, and the degree of emphasis placed on the ethics-related material, the perceived level of importance placed on the ethical issues could have been an effective measure. Additional investigation needs to be done regarding the benchmark standard for the ethical dimension.

The scope of the survey population could be enlarged to include large public and private universities. These professors have a large number of students and teach outside any religious context. The survey responses may vary at the larger institutions. In contrast to the other small, church-related liberal arts colleges, Indiana University at Kokomo is a public university. The inclusion of Indiana University at Kokomo represents a limitation since the culture of institutions of higher education is very much impacted by whether they are sectarian or non-sectarian. The researcher conducted this dissertation study within the context of religiously-oriented institutions because of the potential impact of the culture of these schools on the values and beliefs of faculty and students. While the expectation remained that more work will be needed regarding the effective integration of ethics within the database course, the researcher hypothesized that a greater level of ethical awareness would exist within the context of the church-related institutions.

Another experiment could involve a study of non-academic information technology professionals who currently work in the database area of computer science. A

comparison could be made between the IT professional sample and a group of computer science professors with the goal of identifying additional database-related ethical situations. This survey would provide realistic suggestions for integrating ethics in the database classroom.

The survey in this dissertation lacked both gender and race diversity. A sample from minority and women professor populations could be compared with existing data to generate new information concerning the exploration of moral issues in the database course. While this research dealt with an educator population, studies could be designed to focus on the K-12 (students and teachers) and college student populations. One interesting study could compare high school seniors with recent college graduates to measure effectiveness of various "integration" initiatives. Another study could assess the ability of students to apply ethics to specific technical-related situations. Additionally, K-12 students could be studied to identify various ethical issues that require attention at the college level. With this type of study, such issues as the distinction between real and virtual property come to mind.

Another excellent study could be designed to identify the database-related issues collected in the very broad ABET computer science survey addressed in the literature review. This set of data would be valuable in the construction of a more detailed framework for the integration of ethics into the database area of computer science.

A more philosophical dissertation could focus on the effectiveness of specific ethical theories in database-related ethical decision-making. A comparison could be made regarding how moral decisions are made using various ethical theories. Perhaps

one theory (e.g. natural law) would result in a greater level of consistency when compared with the application of other ethical theories.

The integration of ethics into the database course will soon be a priority in the college classroom. Even with this study completed, the proper connection between the various technical elements of the database course and the ethical component has not been completely resolved. This dissertation highlights various ethical issues within the database context and presents sample case studies (see Chapter 6) to illustrate the ethical integration process. Future researchers can develop a comprehensive model for integrating ethics into the database course with general-level goals, instructional-level goals, specific-level objectives, lesson plans, sample technology-related ethical issues, case studies, and supporting lab assignments. Furthermore, as technology advances in the vastness of the future, the state of the integration efforts will remain dynamic. As new technologies emerge, computer science professors must keep abreast of not only the technical aspects but also how ethics can guide actions for the greater good of humanity.

Chapter 6: Sample Case Studies

The purpose of this chapter is to present sample case studies to illustrate the ethical integration process that can help students make right choices as they encounter database-related moral problems. The researcher selected several significant ethical issues and developed case studies to assist computer science professors regarding the effective integration of ethics into the database course. More importantly, such case studies provide a setting for the utilization of the natural law ethical framework (or other theory) in making moral decisions. This practice will help students in the process of seeking moral truth as ethical problems present themselves under the cover of technology that is considered by many to be good regardless of the circumstances and consequences involved. While the following cases illustrate the technical context surrounding database design and development, computer science professors may use similar thought processes to develop additional cases to help students grasp moral truth regarding any ethical issue that my be encountered during the presentation of the technical material.

The overall general-level goals for the entire course should contain at least one ethics-related item. The ethics-related goal at the general level is written in a very broad manner using such terms as "understand." Likewise, the goals for each instructional unit could include selected ethics-related items. Like the general-level goals, these instructional goals should be written without any specific measurable criteria. However, the specific-level objectives for each set of instructional goals need to be written with an emphasis on being concrete, overt, and measurable. Professors should consider the ethical issues that relate to the technical content at this point in the course development. The set of technical objectives can be enhanced by the addition of specific-level

objectives that pertain to the major ethical issues that have an impact on each particular area of technical content. The inclusion of ethical issues in the course goals and objectives represents the key task in the effective integration of ethics into the database course. The integration of ethics in the database course occurs when the ethics-related objectives are addressed during the presentation of technical material.

After a comprehensive examination of a particular technical concept, the opportunity arises to discuss the related ethical issues. The professor could establish a small-group setting where the students have the opportunity to discuss a given case, suggest additional ethical concerns, and practice making effective moral decisions. The resolution process becomes the primary learning activity because the problem-solving experience provides valuable insights into the nature of effective technical moral decision-making in the future.

In this section, the researcher presents a set of case studies designed to illustrate a subset of the technical-related ethical issues that can emerge while working within the scope of database technology. The following cases not only provide examples that could be utilized in the database classroom, but illustrate various situations for the application of an effective moral decision-making process.

Case Study 1

The first case pertains to the query language section of the information management course. The sales manager has been with the company for over fifteen years. It is common knowledge that the sales manager has been frustrated with both the company's inability to increase revenue and the net losses that have occurred in recent years. During a meeting with Dave, the database administrator, the sales manager

requested a SQL statement that could produce an output relation for all of the sales manager's customers with contact information along with product history detailing customer purchases for the last five years. While this type of request is common, the additional request regarding the placement of this information on a compact disk (CD) raised an ethical flag in the database administrator's mind. Instead of providing the information immediately, the database administrator told the sales manager that there were some higher priority items to complete first. Dave took his responsibility to protect corporate data very seriously and concluded that he would not complete the sale manager's request until he had a chance to investigate the situation more thoroughly. Therefore, Dave thought it would be a good idea to collect facts regarding the circumstances surrounding the situation. During this fact-finding mission, Dave discovered that one of the database programmers had found the sales manager's resume near the printer. Dave thought about the possible consequences surrounding the lack of security associated with the customer and product data being stored on a CD, especially the possibility of the information ending up in another company's system. It was late in the day and Dave said to himself, "I will think about the entire situation tonight and make a decision based on what I truly feel is correct tomorrow."

The universal ethical principles of integrity, honesty, privacy, and responsibility played an important role in Dave's moral decision-making process surrounding this case. There are several choices evident in this dilemma. If Dave approaches the sales manager, an argument may be initiated. Therefore, Dave might cast unwarranted suspicion on the beleaguered manager. Dave could get into serious trouble for not complying with the request in a timely manner. The delay of other requests could cause harm to fellow

employees within the organization. The question of whether there are any policies regarding the burning of CDs need to be answered. Additional questions and concerns arise as the ethical dilemma becomes more focused. The computer science professor may extend the learning experience beyond the small group discussion to encompass a simulation exercise where an actual database environment is used. Questions could arise regarding the output size, storage and processing requirements, time considerations, and whether the students should run the query in the lab.

Case Study 2

The second case involves the issue of privacy and specifically relates to the database concept known as depersonalization. Mary is a database programmer at an Ohio hospital. One afternoon a request came through to produce a comma-delimited file with the patient's social security number, name, primary diagnosis code, and insurance company information. It was mentioned that the file was to be sent to a respectable research firm for statistical analysis. The information technology director assured Mary that the data was going to be destroyed after being used for statistical purposes. The information technology manager told Mary that the executive director wanted the file sent via the Internet this afternoon and said, "Do not spend extra time to write a depersonalization program." With the good reputation of the research firm, Mary thought about the ethical nature of this task and something within told her to proceed with caution. Mary started to get worried after thinking about the possibility of future negative consequences including identity theft.

The universal ethical principles of privacy and responsibility provided a stable footing for Mary's selection of right choices in this case. Mary could produce the file

without question or disobey the director on the other extreme. Perhaps Mary could work overtime to cleanse the data at the expense of her personal life and possible censure at work. What are the technical aspects of the depersonalization process? Mary could remove fields or place generic data in the sensitive attributes. What are the consequences of sending the data over the Internet? Mary thought about the use of encryption to maintain a higher level of privacy. While Mary felt overwhelmed by the ethical dimension associated with this problem, she knew that the depersonalization choice was the best and right alternative. The ethical integration process could be enhanced significantly by a programming assignment supported by a hypothetical patient database.

Case Study 3

Scott has had a wonderful career as a database administrator at a major Kentucky racetrack for over twenty years. While he does not partake in gambling, he enjoys being with the horses and volunteers at a western Kentucky horse farm during his free time. However, Scott is heavily in debt because of medical expenses associated with his ailing child. One of Scott's coworkers, who has only been with the company for less than a year, asked Scott if he wanted to go golfing. While on the course, the programmer asked Scott if he would disable the database audit mechanism so an un-detectable change could be made to one of the wager records immediately after the second race of the day. He told Scott, "I will bet 20 thousand and I will give you 10 grand for helping me." Scott immediately thought to himself, "WOW – This is wrong!"

There are several questions associated with this clear-cut case. Who would be harmed by the undetectable change in the wager record? Does the benefit of helping his child outweigh the risk of doing wrong? What about the status of Scott's friendship with

the coworker? How does the universal principle of ethics involving honesty contribute to the final decision? What are the consequences of whistle blowing? From a technical standpoint, how can changes to the data remain detectable through audit trails, automatic change logs, and effective monitoring procedures even when certain control features are disabled? This case could provide the computer science professor with an excellent opportunity to experiment with database management system features. A lab exercise could focus on the enabling of automatic audit trails and could lead to a discussion concerning the implementation of effective policies for monitoring data change history.

Case Study 4

Doreen has been working on a new software product built upon an existing database that her company developed several years ago for another application. While several of the attributes are the same, many of the fields in the old system are not utilized in the new software product. The project manager mentioned that due to time and cost constraints Doreen should copy the existing dictionary and use the old database structure without any revisions. The project manager simply stated, "It just means that many of the attributes will just contain no data – not a big deal."

In contrast to any matter of right of wrong, this case pertains primarily to guesses about the likelihood and cost of future problems. What are Doreen's alternatives and associated consequences? Perhaps internal and external documentation could address the ethical issues that have emerged in this case study. The students could discuss how the final decision in this case would affect software maintenance activities and the overall integrity of the proposed database.

The above technical oriented database cases illustrate the ethical component that closely parallels the technical activities within the information management area of computer science. The development of these cases becomes much easier when ethical issues are addressed in the course goals and objectives. When professors stress the importance of ethics within the database area, many technical moral problems emerge out of student discussions. This level of ethical awareness regarding both issues and decision-making enhances student learning beyond the knowledge of technical material to the higher level of evaluation. When students gain experience with moral evaluation in the classroom, the state of the computer science discipline becomes brighter as these information technology professionals strive to make better technical-related ethical choices in the future.

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Appendix A

Study Information Letter Given to Participants

Malone College
Math & Computer Science
515 25th Street N.W.
Canton, OH 44709-3897

jglasgow@malone.edu

September 7, 2004

Dear CCC Computer Science Professor:

My name is James F. Glasgow and I have been teaching Computer Science at Malone College in Canton, Ohio for six years. I am working on an interdisciplinary dissertation entitled, ***The Integration of Ethics in a Computer Science Database Course***. The attached survey will provide important data for my recommendations concerning the database course. Thank you if you have already completed the survey. If you have not had a chance to complete the survey, the short time required to complete the questionnaire will be extremely appreciated. Please email, fax, or mail the completed survey. The IRB Consent Form can be faxed (330) 471-8563 or returned via US mail by September 15, 2004. I sent this during the summer but most of you were on vacation. Thank you very much.

Sincerely,

James F. Glasgow

Appendix B

Informed Consent Form Given to Participants

Research with Human Subjects
June 29, 2004
Dear Research Participant:

I am conducting a study of CCC Computer Science professors as part of my Ph.D. program in Computer Ethics at the Union Institute & University. Information about this research project will increase our understanding of how to effectively integrate ethics in the undergraduate database course and will help in future curriculum development for the database area.

Please complete the attached survey questionnaire. Your involvement will require about 10 minutes of your time. After the research is completed, I will forward a summary of my findings and the implications of those findings to you by email. I am not aware of any risks involved in participating in this project. All responses will be confidential and your name will not be used in any report regarding this research. You are free to decline to participate or to withdraw at any time.

If you have any questions about this study, please contact me at (330) 471-8372. Please leave a message if I am not immediately available. Thank you.
Sincerely,
James F. Glasgow

I, _____, consent to participate in the study of Computer Ethics, conducted by James F. Glasgow. I understand that I may refuse to participate or withdraw from this study at any time. I understand that all responses will be confidential. I understand that I may direct questions about this project to James F. Glasgow.

_____ _____
Signature Date

Please **mail** or **fax** this form to Prof. James F. Glasgow (330) 471-8563.
Please return the survey via **email** (jglasgow@malone.edu) or **mail** to:

Prof. James F. Glasgow
Malone College
Math & Computer Science Dept.
515 25th Street N.W.
Canton, OH 44709-3897

The Human Research Committees of Malone and TUI have approved this survey. If you have any questions about ethics in human research, please contact Dr. Lauren Seifert, Chair of Malone College's institutional review board at (330) 471-8558 or The Union Institute & University Institutional Review Board at (800) 486-3116

Appendix C

Survey Questionnaire

James F. Glasgow
Assistant Professor of Computer Science
Malone College
Canton, Ohio

CCC Computer Science Professor Survey
For a doctoral dissertation in Computer Ethics from the Union Institute & University
August 31, 2004

(Place X or 1-5 range before underline for email response)

General Information

1. Please indicate the range that best describes your age.
   _____ Under 30
   _____ 30-39
   _____ 40-49
   _____ 50-59
   _____ 60+

2. How much formal education do you have?
   _____ Doctoral Level
   _____ Masters Level
   _____ Other

3. What discipline was your highest degree in?
   _____ Computer Science
   _____ Math
   _____ Business
   _____ Education
   _____ Other

4. Please indicate your gender.
   _____ Male
   _____ Female

5. What is your race?
   _____ American Indian or Alaska Native
   _____ Asian
   _____ Black or African American
   _____ Hispanic or Latino
   _____ Native Hawaiian or other Pacific Islander

_____ White

6. Do you work in an urban or rural area?
_____ Rural
_____ Urban

7. How many years have you worked in your current position?
_____ Less than one year
_____ 1 and under 5 years
_____ 5 and under 10 years
_____ 10 and under 20 years
_____ 20 and under 30 years
_____ 30 years or more

8. How many years have you been teaching at the college level?
_____ Less than one year
_____ 1 and under 5 years
_____ 5 and under 10 years
_____ 10 and under 20 years
_____ 20 and under 30 years
_____ 30 years or more

General Computer Ethics Information

[Please select **all** that apply in the following questions]

9. In general, how do you teach Ethics in the undergraduate technical Computer Science courses?
_____ Separate Computer Ethics course
_____ Senior Seminar setting
_____ Integrated spontaneously in the technical courses
_____ Integrated based on previously published guidelines
_____ We rarely discuss ethics in our Computer Science curriculum

10. What teaching approaches have been most effective for teaching the ethics component?
_____ Lecture
_____ Group Discussion
_____ Student Research & Presentations
_____ Other _____

11. Who teaches the ethical component within the Computer Science course of study?
_____ Computer Science professors
_____ Philosophy professors
_____ Business professors
_____ Other _____

12. How do you evaluate student performance in the ethics area?
_____ tests
_____ writing quality
_____ presentations
_____ group interaction
_____ Other _____

[Please select **one** response for the following questions]

13. Do you discuss ethical theories before presenting the detail moral issues that have an impact on the Computer Science field?
_____ Yes
_____ No

14. With the effective integration of ethics in the computing curriculum, is it necessary to offer an upper-level capstone Computer Ethics course?
_____ Yes
_____ No

15. Should there be a dedicated course in Computer Ethics? If yes, what Level?
_____ Yes _____No

_____ Freshman
_____ Sophomore
_____ Junior
_____ Senior

II. Specific Database Course Information

16. Have you taught the database course?
_____ Yes
_____ No

[Please indicate the ***level of coverage*** for each of the **ethics related** items within the following database sections. If you have taught the database course, your answers should correspond with the material that **you covered** in the database course. If you have not taught the database course, please answer based on what you **would do** if you had the opportunity to teach the course.]

IM1: Information Models and Systems:

Not Covered 1…..2…..3…..4…..5 Covered Extensively

____ 17. 1 2 3 4 5 privacy in a general context of databases

____ 18. 1 2 3 4 5 the concept of integrity

____ 19. 1 2 3 4 5 the issue of security

____ 20. 1 2 3 4 5 the issue of information preservation

Not Covered 1…..2…..3…..4…..5 Covered Extensively

____ 21. 1 2 3 4 5 the ethical ramification of database backup policies

____ 22. 1 2 3 4 5 the ethical issues relating to the importance of scalability

IM2: Database Systems:

____ 23. 1 2 3 4 5 the observation that database systems can be more ethical than flat-files

____ 24. 1 2 3 4 5 how data duplication results in harm to users and technical people

____ 25. 1 2 3 4 5 the social impact of database technology

____ 26. 1 2 3 4 5 ethical issues involving the concept of data independence

____ 27. 1 2 3 4 5 the ethical problems associated with using a powerful query language

IM3: Data Modeling

____ 28. 1 2 3 4 5 consequences that arise from not doing an effective job with data modeling

____ 29. 1 2 3 4 5 the importance of keeping current with the latest data modeling techniques

____ 30. 1 2 3 4 5 the utilization of the relational model can result in a higher level of integrity

____ 31. 1 2 3 4 5 the relationship of responsibility to the process of data modeling

III. IM4: Relational Databases

____ 32. 1 2 3 4 5 why an effective relational schema is important

____ 33. 1 2 3 4 5 how relational algebra can result in a higher level of database integrity

IV.

V. IM5: Database Query Languages

____ 34. 1 2 3 4 5 the ethical concerns associated with query language update statements

____ 35. 1 2 3 4 5 the ethical issues surrounding the concept of audit trails

____ 36. 1 2 3 4 5 the relationship between database accuracy and query language updates

____ 37. 1 2 3 4 5 how database queries relate to the issue of information privacy

Not Covered 1…..2…..3…..4…..5 Covered Extensively

____ 38. 1 2 3 4 5 the role of the database administrator in addressing SQL-related ethical issues

VI. IM6: Relational database design

____ 39. 1 2 3 4 5 the ethics involving the use of normal forms for an effective database design

____ 40. 1 2 3 4 5 an ineffective database design could result in harm, a lack of integrity & stress

VII. IM7: Transaction processing

____ 41. 1 2 3 4 5 the importance of mutual exclusion when processing transaction records

____ 42. 1 2 3 4 5 ethical issues related to sensitive information like social security #s and credit cards

____ 43. 1 2 3 4 5 the concept of depersonalizing transaction records

VIII. IM8: Distributed databases

____ 44. 1 2 3 4 5 properly committing a transaction to databases stored on multiple nodes

____ 45. 1 2 3 4 5 a proper level of security in a distributed database environment

IX. IM9: Physical database design

____ 46. 1 2 3 4 5 the effect of algorithms and data structures on integrity

X. IM10: Data mining

____ 47. 1 2 3 4 5 the ethical dimensions that are associated with data mining

____ 48. 1 2 3 4 5 the relationship between privacy and data mining

____ 49. 1 2 3 4 5 the unethical selling of customer information

XI.
XII. IM11: Information storage and retrieval

____ 50. 1 2 3 4 5 the various "invisibility factor" issues such as search engine bias

Not Covered 1…..2…..3…..4…..5 Covered Extensively

____ 51. 1 2 3 4 5 the importance of using such technology as RAID to prevent loss of information

XIII.
XIV. IM12: Hypertext and hypermedia

____ 52. 1 2 3 4 5 the ethical issues that are related to information presentation

XV. IM13: Multimedia information and systems

____ 53. 1 2 3 4 5 the appropriate use of multimedia presentations

XVI. IM14: Digital libraries

____ 54. 1 2 3 4 5 the issue of intellectual property rights within the context of digital libraries

____ 55. 1 2 3 4 5 the ethical concerns surrounding archiving and preservation for digital libraries

____ 56. 1 2 3 4 5 the integrity and accuracy of information stored in a digital library

Other Information

57. List any ethical issues not mentioned in this survey that you consider important for the database course.

_____
_____
_____
_____

*** Thank You ***

Appendix D

ACM Code of Ethics and Professional Conduct

Preamble

Commitment to ethical professional conduct is expected of every member (voting members, associate members, and student members) of the Association for Computing Machinery (ACM).

This Code, consisting of 24 imperatives formulated as statements of personal responsibility, identifies the elements of such a commitment. It contains many, but not all, issues professionals are likely to face.Section 1 outlines fundamental ethical considerations, while Section 2 addresses additional, more specific considerations of professional conduct. Statements in Section 3 pertain more specifically to individuals who have a leadership role, whether in the workplace or in a volunteer capacity such as with organizations like ACM. Principles involving compliance with this Code are given in Section 4.

The Code shall be supplemented by a set of Guidelines, which provide explanation to assist members in dealing with the various issues contained in the Code. It is expected that the Guidelines will be changed more frequently than the Code.

The Code and its supplemented Guidelines are intended to serve as a basis for ethical decision making in the conduct of professional work. Secondarily, they may serve as a basis for judging the merit of a formal complaint pertaining to violation of professional ethical standards.

It should be noted that although computing is not mentioned in the imperatives of Section 1, the Code is concerned with how these fundamental imperatives apply to one's conduct as a computing professional. These imperatives are expressed in a general form to emphasize that ethical principles which apply to computer ethics are derived from more general ethical principles.

It is understood that some words and phrases in a code of ethics are subject to varying interpretations, and that any ethical principle may conflict with other ethical principles in specific situations. Questions related to ethical conflicts can best be answered by thoughtful consideration of fundamental principles, rather than reliance on detailed regulations.

1. GENERAL MORAL IMPERATIVES.

As an ACM member I will ....

1.1 Contribute to society and human well-being.

This principle concerning the quality of life of all people affirms an obligation to protect fundamental human rights and to respect the diversity of all cultures. An essential aim of computing professionals is to minimize negative consequences of computing systems, including threats to health and safety. When designing or implementing systems, computing professionals must attempt to ensure that the products of their efforts will be used in socially responsible ways, will meet social needs, and will avoid harmful effects to health and welfare.

In addition to a safe social environment, human well-being includes a safe natural environment. Therefore, computing professionals who design and develop systems must be alert to, and make others aware of, any potential damage to the local or global environment.

1.2 Avoid harm to others.

"Harm" means injury or negative consequences, such as undesirable loss of information, loss of property, property damage, or unwanted environmental impacts. This principle prohibits use of computing technology in ways that result in harm to any of the following: users, the general public, employees, employers. Harmful actions include intentional destruction or modification of files and programs leading to serious loss of resources or unnecessary expenditure of human resources such as the time and effort required to purge systems of "computer viruses."

Well-intended actions, including those that accomplish assigned duties, may lead to harm unexpectedly. In such an event the responsible person or persons are obligated to undo or mitigate the negative consequences as much as possible. One way to avoid unintentional harm is to carefully consider potential impacts on all those affected by decisions made during design and implementation.

To minimize the possibility of indirectly harming others, computing professionals must minimize malfunctions by following generally accepted standards for system design and testing. Furthermore, it is often necessary to assess the social consequences of systems to project the likelihood of any serious harm to others. If system features are misrepresented to users, coworkers, or supervisors, the individual computing professional is responsible for any resulting injury.

In the work environment the computing professional has the additional obligation to report any signs of system dangers that might result in serious personal or social damage. If one's superiors do not act to curtail or mitigate such dangers, it may be necessary to "blow the whistle" to help correct the problem or reduce the risk. However, capricious or misguided reporting of violations can, itself, be harmful. Before reporting violations, all relevant aspects of the incident must be thoroughly assessed. In particular, the assessment of risk and responsibility must be credible. It is suggested that advice be sought from other computing professionals. See principle 2.5 regarding thorough evaluations.

1.3 Be honest and trustworthy.

Honesty is an essential component of trust. Without trust an organization cannot function effectively. The honest computing professional will not make deliberately false or deceptive claims about a system or system design, but will instead provide full disclosure of all pertinent system limitations and problems.

A computer professional has a duty to be honest about his or her own qualifications, and about any circumstances that might lead to conflicts of interest.

Membership in volunteer organizations such as ACM may at times place individuals in situations where their statements or actions could be interpreted as carrying the "weight" of a larger group of professionals. An ACM member will exercise care to not misrepresent ACM or positions and policies of ACM or any ACM units.

1.4 Be fair and take action not to discriminate.

The values of equality, tolerance, respect for others, and the principles of equal justice govern this imperative. Discrimination on the basis of race, sex, religion, age, disability,

national origin, or other such factors is an explicit violation of ACM policy and will not be tolerated.

Inequities between different groups of people may result from the use or misuse of information and technology. In a fair society,all individuals would have equal opportunity to participate in, or benefit from, the use of computer resources regardless of race, sex, religion, age, disability, national origin or other such similar factors. However, these ideals do not justify unauthorized use of computer resources nor do they provide an adequate basis for violation of any other ethical imperatives of this code.

1.5 Honor property rights including copyrights and patent.

Violation of copyrights, patents, trade secrets and the terms of license agreements is prohibited by law in most circumstances. Even when software is not so protected, such violations are contrary to professional behavior. Copies of software should be made only with proper authorization. Unauthorized duplication of materials must not be condoned.

1.6 Give proper credit for intellectual property.

Computing professionals are obligated to protect the integrity of intellectual property. Specifically, one must not take credit for other's ideas or work, even in cases where the work has not been explicitly protected by copyright, patent, etc.

1.7 Respect the privacy of others.

Computing and communication technology enables the collection and exchange of personal information on a scale unprecedented in the history of civilization. Thus there is increased potential for violating the privacy of individuals and groups. It is the responsibility of professionals to maintain the privacy and integrity of data describing individuals. This includes taking precautions to ensure the accuracy of data, as well as protecting it from unauthorized access or accidental disclosure to inappropriate individuals. Furthermore, procedures must be established to allow individuals to review their records and correct inaccuracies.

This imperative implies that only the necessary amount of personal information be collected in a system, that retention and disposal periods for that information be clearly defined and enforced, and that personal information gathered for a specific purpose not be used for other purposes without consent of the individual(s). These principles apply to electronic communications, including electronic mail, and prohibit procedures that capture or monitor electronic user data, including messages,without the permission of users or bona fide authorization related to system operation and maintenance. User data observed during the normal duties of system operation and maintenance must be treated with strictest confidentiality, except in cases where it is evidence for the violation of law, organizational regulations, or this Code. In these cases, the nature or contents of that information must be disclosed only to proper authorities.

1.8 Honor confidentiality.

The principle of honesty extends to issues of confidentiality of information whenever one has made an explicit promise to honor confidentiality or, implicitly, when private information not directly related to the performance of one's duties becomes available. The ethical concern is to respect all obligations of confidentiality to employers, clients, and users unless discharged from such obligations by requirements of the law or other principles of this Code.

2. MORE SPECIFIC PROFESSIONAL RESPONSIBILITIES.
As an ACM computing professional I will ....

2.1 Strive to achieve the highest quality, effectiveness and dignity in both the process and products of professional work.
Excellence is perhaps the most important obligation of a professional. The computing professional must strive to achieve quality and to be cognizant of the serious negative consequences that may result from poor quality in a system.
2.2 Acquire and maintain professional competence.
Excellence depends on individuals who take responsibility for acquiring and maintaining professional competence. A professional must participate in setting standards for appropriate levels of competence, and strive to achieve those standards. Upgrading technical knowledge and competence can be achieved in several ways:doing independent study; attending seminars, conferences, or courses; and being involved in professional organizations.
2.3 Know and respect existing laws pertaining to professional work.
ACM members must obey existing local, state,province, national, and international laws unless there is a compelling ethical basis not to do so. Policies and procedures of the organizations in which one participates must also be obeyed. But compliance must be balanced with the recognition that sometimes existing laws and rules may be immoral or inappropriate and, therefore, must be challenged. Violation of a law or regulation may be ethical when that law or rule has inadequate moral basis or when it conflicts with another law judged to be more important. If one decides to violate a law or rule because it is viewed as unethical, or for any other reason, one must fully accept responsibility for one's actions and for the consequences.
2.4 Accept and provide appropriate professional review.
Quality professional work, especially in the computing profession, depends on professional reviewing and critiquing. Whenever appropriate, individual members should seek and utilize peer review as well as provide critical review of the work of others.
2.5 Give comprehensive and thorough evaluations of computer systems and their impacts, including analysis of possible risks.
Computer professionals must strive to be perceptive, thorough, and objective when evaluating, recommending, and presenting system descriptions and alternatives. Computer professionals are in a position of special trust, and therefore have a special responsibility to provide objective, credible evaluations to employers, clients, users, and the public. When providing evaluations the professional must also identify any relevant conflicts of interest, as stated in imperative 1.3.
As noted in the discussion of principle 1.2 on avoiding harm, any signs of danger from systems must be reported to those who have opportunity and/or responsibility to resolve them. See the guidelines for imperative 1.2 for more details concerning harm,including the reporting of professional violations.
2.6 Honor contracts, agreements, and assigned responsibilities.
Honoring one's commitments is a matter of integrity and honesty.For the computer professional this includes ensuring that system elements perform as intended. Also, when

one contracts for work with another party, one has an obligation to keep that party properly informed about progress toward completing that work.
A computing professional has a responsibility to request a change in any assignment that he or she feels cannot be completed as defined. Only after serious consideration and with full disclosure of risks and concerns to the employer or client, should one accept the assignment. The major underlying principle here is the obligation to accept personal accountability for professional work. On some occasions other ethical principles may take greater priority.
A judgment that a specific assignment should not be performed may not be accepted. Having clearly identified one's concerns and reasons for that judgment, but failing to procure a change in that assignment, one may yet be obligated, by contract or by law, to proceed as directed. The computing professional's ethical judgment should be the final guide in deciding whether or not to proceed. Regardless of the decision, one must accept the responsibility for the consequences.
However, performing assignments "against one's own judgment" does not relieve the professional of responsibility for any negative consequences.

2.7 Improve public understanding of computing and its consequences.
Computing professionals have a responsibility to share technical knowledge with the public by encouraging understanding of computing, including the impacts of computer systems and their limitations. This imperative implies an obligation to counter any false views related to computing.

2.8 Access computing and communication resources only when authorized to do so.
Theft or destruction of tangible and electronic property is prohibited by imperative 1.2 - "Avoid harm to others." Trespassing and unauthorized use of a computer or communication system is addressed by this imperative. Trespassing includes accessing communication networks and computer systems, or accounts and/or files associated with those systems, without explicit authorization to do so. Individuals and organizations have the right to restrict access to their systems so long as they do not violate the discrimination principle (see 1.4). No one should enter or use another's computer system, software, or data files without permission. One must always have appropriate approval before using system resources, including communication ports, file space, other system peripherals, and computer time.

3. ORGANIZATIONAL LEADERSHIP IMPERATIVES.

As an ACM member and an organizational leader, I will ....

BACKGROUND NOTE:This section draws extensively from the draft IFIP Code of Ethics,especially its sections on organizational ethics and international concerns. The ethical obligations of organizations tend to be neglected in most codes of professional conduct, perhaps because these codes are written from the perspective of the individual member. This dilemma is addressed by stating these imperatives from the perspective of the organizational leader. In this context"leader" is viewed as any organizational member who has leadership or educational responsibilities. These imperatives generally may apply to organizations as well as their leaders. In this context"organizations" are corporations, government agencies,and other "employers," as well as volunteer professional organizations.

3.1 Articulate social responsibilities of members of an organizational unit and encourage full acceptance of those responsibilities.
Because organizations of all kinds have impacts on the public, they must accept responsibilities to society. Organizational procedures and attitudes oriented toward quality and the welfare of society will reduce harm to members of the public, thereby serving public interest and fulfilling social responsibility. Therefore,organizational leaders must encourage full participation in meeting social responsibilities as well as quality performance.
3.2 Manage personnel and resources to design and build information systems that enhance the quality of working life.
Organizational leaders are responsible for ensuring that computer systems enhance, not degrade, the quality of working life. When implementing a computer system, organizations must consider the personal and professional development, physical safety, and human dignity of all workers. Appropriate human-computer ergonomic standards should be considered in system design and in the workplace.
3.3 Acknowledge and support proper and authorized uses of an organization's computing and communication resources.
Because computer systems can become tools to harm as well as to benefit an organization, the leadership has the responsibility to clearly define appropriate and inappropriate uses of organizational computing resources. While the number and scope of such rules should be minimal, they should be fully enforced when established.
3.4 Ensure that users and those who will be affected by a system have their needs clearly articulated during the assessment and design of requirements; later the system must be validated to meet requirements.
Current system users, potential users and other persons whose lives may be affected by a system must have their needs assessed and incorporated in the statement of requirements. System validation should ensure compliance with those requirements.
3.5 Articulate and support policies that protect the dignity of users and others affected by a computing system.
Designing or implementing systems that deliberately or inadvertently demean individuals or groups is ethically unacceptable. Computer professionals who are in decision making positions should verify that systems are designed and implemented to protect personal privacy and enhance personal dignity.
3.6 Create opportunities for members of the organization to learn the principles and limitations of computer systems.
This complements the imperative on public understanding (2.7). Educational opportunities are essential to facilitate optimal participation of all organizational members. Opportunities must be available to all members to help them improve their knowledge and skills in computing, including courses that familiarize them with the consequences and limitations of particular types of systems.In particular, professionals must be made aware of the dangers of building systems around oversimplified models, the improbability of anticipating and designing for every possible operating condition, and other issues related to the complexity of this profession

4. COMPLIANCE WITH THE CODE.
As an ACM member I will ....

4.1 Uphold and promote the principles of this Code.
The future of the computing profession depends on both technical and ethical excellence. Not only is it important for ACM computing professionals to adhere to the principles expressed in this Code, each member should encourage and support adherence by other members.
4.2 Treat violations of this code as inconsistent with membership in the ACM.
Adherence of professionals to a code of ethics is largely a voluntary matter. However, if a member does not follow this code by engaging in gross misconduct, membership in ACM may be terminated.

Appendix E

AITP Code of Ethics and Standards of Conduct

Code of Ethics

I acknowledge:

That I have an obligation to management, therefore, I shall promote the understanding of information processing methods and procedures to management using every resource at my command.

That I have an obligation to my fellow members, therefore, I shall uphold the high ideals of AITP as outlined in the Association Bylaws. Further, I shall cooperate with my fellow members and shall treat them with honesty and respect at all times.

That I have an obligation to society and will participate to the best of my ability in the dissemination of knowledge pertaining to the general development and understanding of information processing. Further, I shall not use knowledge of a confidential nature to further my personal interest, nor shall I violate the privacy and confidentiality of information entrusted to me or to which I may gain access.

That I have an obligation to my College or University, therefore, I shall uphold its ethical and moral principles.

That I have an obligation to my employer whose trust I hold, therefore, I shall endeavor to discharge this obligation to the best of my ability, to guard my employer's interests, and to advise him or her wisely and honestly.

That I have an obligation to my country, therefore, in my personal, business, and social contacts, I shall uphold my nation and shall honor the chosen way of life of my fellow citizens.

I accept these obligations as a personal responsibility and as a member of this Association. I shall actively discharge these obligations and I dedicate myself to that end.

Standard of Conduct

These standards expand on the Code of Ethics by providing specific statements of behavior in support of each element of the Code. They are not objectives to be strived for, they are rules that no true professional will violate. It is first of all expected that an information processing professional will abide by the appropriate laws of their country and community. The following standards address tenets that apply to the profession.

In recognition of my obligation to management I shall:

- Keep my personal knowledge up-to-date and insure that proper expertise is available when needed.
- Share my knowledge with others and present factual and objective information to management to the best of my ability.
- Accept full responsibility for work that I perform.
- Not misuse the authority entrusted to me.
- Not misrepresent or withhold information concerning the capabilities of equipment, software or systems.
- Not take advantage of the lack of knowledge or inexperience on the part of others.

In recognition of my obligation to my fellow members and the profession I shall:

- Be honest in all my professional relationships.
- Take appropriate action in regard to any illegal or unethical practices that come to my attention. However, I will bring charges against any person only when I have reasonable basis for believing in the truth of the allegations and without any regard to personal interest.
- Endeavor to share my special knowledge.
- Cooperate with others in achieving understanding and in identifying problems.
- Not use or take credit for the work of others without specific acknowledgement and authorization.
- Not take advantage of the lack of knowledge or inexperience on the part of others for personal gain.

In recognition of my obligation to society I shall:

- Protect the privacy and confidentiality of all information entrusted to me.
- Use my skill and knowledge to inform the public in all areas of my expertise.
- To the best of my ability, insure that the products of my work are used in a socially responsible way.
- Support, respect, and abide by the appropriate local, state, provincial, and federal laws.

- Never misrepresent or withhold information that is germane to a problem or situation of public concern nor will I allow any such known information to remain unchallenged.
- Not use knowledge of a confidential or personal nature in any unauthorized manner or to achieve personal gain.

In recognition of my obligation to my employer I shall:

- Make every effort to ensure that I have the most current knowledge and that the proper expertise is available when needed.
- Avoid conflict of interest and insure that my employer is aware of any potential conflicts.
- Present a fair, honest, and objective viewpoint.
- Protect the proper interests of my employer at all times.
- Protect the privacy and confidentiality of all information entrusted to me.
- Not misrepresent or withhold information that is germane to the situation.
- Not attempt to use the resources of my employer for personal gain or for any purpose without proper approval.
- Not exploit the weakness of a computer system for personal gain or personal satisfaction.

Appendix F

Aristotle's Virtue Ethics

Introduction

In the *Nicomachean Ethics*, Aristotle provides an enduring model for moral decision-making in that certain aspects of his theory remain relevant today. While other theories have emerged, primarily from the era of the enlightenment, Aristotle's view of a universal set of normative ethical standards withstands the strong winds of the prevailing utilitarian movement and Kant's variation based on the exclusive use of reason in the determination of what is right and wrong.

In the area of Computer Ethics, the evidence indicates that some researchers are suggesting a return back to virtue ethics due to the flaws and inconsistencies of the deontological and consequentialist ethical theories. Many times the actual consequences of technology-related actions are not known in advance due to the extent and speed of the Internet and its developing innovations. With a virtue ethics approach, the programmer acts according to a set of principles that do not depend merely on the future consequences. While the principles remain clear, future consequences may be cloudy at the decision time. A programmer may release malice code intended for a roommate but find out later that the prank had produced a much broader level of harm. The focus on future consequences proves to be an inadequate road map for traveling down life's moral pathway. Deontological ethical theory is based on moral duty and formal rules or principles to guide behavior rather than future consequences. While deontological theories focus on principles inherent to specific actions, virtue ethics addresses the questions of moral character and the development of human excellence. This emphasis

on the development of good moral character fills a gap left by other ethical theories. With virtue ethics, concern for the well being of one's soul emerges from one's character in contrast to the principles associated with specific actions.

In an examination of a philosophical basis of computer ethics, Johnson (1985/2001) mentions, "Virtue theory seems to fill a gap left by other theories we considered, because it addresses the question of moral character" (p. 51). According to Edgar (1997), "A fairly recent reaction to the inadequacies of Kantian and utilitarian ethical theories has been a return to 'virtue ethics,' which can be seen to have its origin in Aristotle" (p. 65). The issue of moral character stands out as the most distinguishing factor when comparing virtue ethics with the prevailing utilitarian ethical practice in our modern world. The utilitarian movement places an emphasis on the consequences of action in contrast to virtue ethics that places its emphasis on the virtues that form the inner character of an individual. The return by some researchers to Aristotle's approach is especially important considering the critical nature of making correct ethical decisions within the realm of computer science, especially in the database area that is central to the entire field. Since one's character is based on *a priori* principles of right and wrong, virtue ethics provides answers that are more constant across the spectrum of choices within the technical areas. With virtue ethics as a guide for ethical decision-making, the principles of right and wrong are independent of the specific situation. The consistency that is characteristic of virtue ethics theory is what provides a firm and unchanging foundation for moral decision-making.

Aristotle understands that ethics is based on the laws that order the universe. He believes that everything has a function and that these functions are derived from the laws

of the universe. Therefore, human nature is derived from the same laws of the universe that instill purpose in the component parts of the universe. The consistency of virtue ethics is therefore a property of the *a priori* foundation in the laws that order the universe as manifested in human nature. The relationship of function to purpose is true not only for human beings, but for the universe as a whole. In the *Metaphysics*, Aristotle, in discussing the term "prior", said, "in another sense that which is prior for knowledge is treated as also absolutely prior; of these, the things that are prior in definition do not coincide with those that are prior in relation to perception. For in definition universals are prior, in relation to perception" (1018b: 30). Furthermore, in the *Metaphysics*, Aristotle states, "If, then, the principles are universals, these results follow; if they are not universals but of the nature of individuals, they will not be knowable; for the knowledge of anything is universal. Therefore if there is to be knowledge of the principles there must be other principles prior to them, namely those that are universally predicated of them" (1003a: 15). This belief that universal principles are the foundation of true knowledge extends to the concept of virtues that are based on the laws of natural justice that order the universe. In this paper, the researcher examines the ultimate good, the concept of man, moral virtues, intellectual virtues, and Aristotle's concept of justice that provides a synthesis of virtue for the overall good of humanity.

The ultimate good

Aristotle sees the Good as being final and self-sufficient. In his exploration of human nature, Aristotle sees a rational being as the highest form of physical existence. Aristotle sees God as a model of perfection within the universe and remote from the human experience. Aristotle realizes that all human beings naturally desire happiness.

This human drive or internal desire for happiness is inherent to human nature. According to Aristotle, the primary purpose of human life relates to the attainment of the ultimate state of happiness. The pursuit of happiness is a natural function of human kind and is derived from the rational aspect of human nature backed by the laws that order the universe. To Aristotle, happiness represents the fulfillment of the human purpose as instilled in human nature. Concerning what is desirable in itself, Aristotle said, "Now such a thing happiness, above all else, is held to be; for this we choose always for itself and never for the sake of something else…" (1097b: 1-5). Aristotle continues with the statement, "Happiness, then, is something final and self-sufficient, and is the end of action" (1097b: 20).

Aristotle believes that there is a direct relationship between the fulfillment of happiness and the purpose of a human being. Furthermore, Aristotle understands that this purpose leads to the ultimate good and that goodness is the key component of being human. Aristotle equates ethics with one's movement through life toward the good. This movement results in perfection and a complete life. The wisdom of Aristotle's vision regarding the experience of human life is timeless and enduring. It is in our human nature to live a complete life full of accomplishment and void of as many regrets as possible. The brilliance of Aristotle's virtue ethics theory is its long-term focus on true happiness. While the pleasures of money and friendship are not excluded, Aristotle sees the ultimate good as being much more than short-term pleasure. His blueprint for a complete and fulfilling life is very comprehensive and places excellence as the standard for all human endeavors. The human characteristic of worrying too much can be reduced with the application of Aristotle's theory because one adds the love of goodness as the

control to one's thinking and appetites, when faced with life's many challenges and opportunities. With excellence in character, study, family, work, friendships, play, and all other aspects of living, true earthly happiness emerges and can extend beyond a single individual to benefit society as a whole. Aristotle's theory pertains to all human beings regardless of work and life circumstances. His understanding of the human condition serves as a guide for life and helps in the understanding of what it truly is to be human.

Aristotle believes that human nature reveals that the capacity to reason is our distinctive element and that the ultimate goal of humans is to develop their capacity to reason. Aristotle believes that when human beings develop their reasoning skills, they become more attuned to their true nature involving the attainment of the ultimate good. The application of reason provides a key activity on the road to happiness and reflects the true purpose of being human. The application of reason in one's journey through life provides control that in turn helps an individual achieve a complete and satisfying life. The next section concerning Aristotle's concept of man examines the great philosopher's notions concerning the structure and purpose of the human soul and investigates how a synthesis of ethics and reason provides guidance on the path to completeness, perfection, and the ultimate good represented by happiness.

The concept of man

Aristotle sees reason as the faculty that sets humankind apart from the other members of the animal kingdom. He believes that our higher status is due to our rational capabilities. Aristotle insists that man is a social being with a natural desire for the good and is representative (capable) of the highest good in the universe. Aristotle sees human kind as a summit in the universe primarily because he sees rational beings as the highest

form of physical existence. Aristotle sees reason as the facility from which the ethical being emerges through free will and human choices. According to Aristotle, every creature has its special good that is related to its nature, purpose and associated function. The function of man is to live as a rational being and act intelligently. This purpose is achieved through the exercise of the human soul. This virtue of soul allows human beings to perform in a way that leads to completeness and perfection.

The human soul. Aristotle's philosophical framework suggests that human beings are comprised of a dichotomy of form and matter. The reference to form pertains to the human soul. Aristotle considers the soul as the basis of thought and is, along with the body, an integral part of being human. In *On the Soul*, Aristotle said, "Hence the soul must be a substance in the sense of the form of a natural body having life potentially within it" (412a: 20). Aristotle continues with the statement, "It is substance in the sense which corresponds to the definitive formula of a thing's essence. That means that it is 'the essential whatness' of a body…" (412b: 10). While Aristotle discusses the soul as the human mind separate and distinct from the physical body, he sees the soul, especially the metabolic section of the irrational soul, as the controlling element of the overall individual. Aristotle does not consider the human soul to be eternal. Concerning the possibility of happiness being affected by descendants, Aristotle said, "It would be odd, then, if the dead man were to share in these changes and become at one time happy, at another wretched…" (1100a: 25-30) For the living, he sees human virtue and happiness as being directly related to the soul. Aristotle continues to refer to the human mind as the soul. Aristotle states, "By human virtue we mean not that of the body but that of the soul: and happiness also we call an activity of soul" (1102a: 15). Aristotle sees the soul as the

driving force for the body. According to Aristotle, all of the rational and irrational thinking that presupposes action is a function of the soul.

Structure of the soul. Aristotle structures the human soul into two distinct parts: the Rational and Irrational. Intellectual and practical wisdom were said to reside in the Rational Soul while health and moral virtue were believed to be the product of the Irrational Soul. Aristotle sees both segments of the soul as important in the attainment of the primary purpose of humankind – the ultimate good represented by happiness. The path to happiness is influenced by the controlling force of ethics, the utilization of human reason within the rational soul and habit within the domain of the irrational soul. In using the concept of hierarchy to deal with complexity, Aristotle subdivides each part of the soul into smaller more detailed functional units. Aristotle's overall structure of the human soul is illustrated in figure G.1. The next section examines Aristotle's ideas concerning the rational soul.

Figure G.1

Rational Soul

Intellectual Reason → Philosophical Reasoning → Intellectual Wisdom

Practical Reason → Political Reasoning → Practical Wisdom

Irrational Soul

Appetitive Soul → Good Characteristics → Moral Virtue

Metabolic Soul → Health → Diet and Exercise

Rational soul. Aristotle organizes the Rational Soul into two sub areas labeled Intellectual Reason and Practical Reason. Intellectual reason was further denoted as consisting of philosophical reasoning that leads to intellectual wisdom. The intellectual

virtues are regarded by Aristotle as being on a higher plane than the moral virtues and directly related to the rational aspect of the soul. The rational soul has a direct relationship to the concept of goodness since the development of reason is paramount to the purpose and goal of being human. Aristotle places the intellectual virtues at the top of the ethical hierarchy because he sees philosophical reasoning as superior to the reactive nature of the irrational soul.

Concerning the virtues of character, Aristotle states that philosophical wisdom is, "of the things that are highest by nature" (1141b: 1-5). He sees reason as the facility that sets humans apart from animals and allows us to possess the truth. Aristotle believes that living well occurs when an individual lives in accord with a human being's highest ability, which is reason.

Practical wisdom, enjoying its most sophisticated form in political reasoning, was considered the human characteristic arising from the use of Practical Reason. Practical Reason involves solving particular problems by deliberating well for the sake of oneself, family, and society. Aristotle sees moral virtue as an important integrant for practical wisdom. Furthermore, Aristotle sees practical wisdom as a required element for the process of being good. Aristotle says in (1144b: 30), "it is not possible to be good in the strict sense without practical wisdom, nor practically wise without moral virtue." Therefore, Aristotle sees practical wisdom as a bridge between moral virtue and intellectual wisdom.

Intellectual virtues. The intellectual virtues relate to the exercise of the function of human reason to fulfill one's purpose involving the attainment of the ultimate good. Through philosophical and practical reasoning, the rational soul becomes exercised to its

full potential. Intellectual and practical wisdom emerge from the effective utilization of the human capacity of reason. This wisdom along with moral virtue represents the way to a good life.

Aristotle believes that the intellectual virtues result from teaching and, like moral virtues, requires experience and time for study. Humans are not born with intellectual wisdom. We acquire intellectual virtues through the interaction with more experienced teachers. This interaction allows one to learn from those who have already obtained wisdom and to accelerate the progression toward the ultimate good. Aristotle realizes that reason is of great importance in the development of intellectual wisdom.

Aristotle envisions two parts that can grasp a rational principle with the statement, "Let one of these parts be called the scientific and the other the calculative; for to deliberate and to calculate are the same thing, but no one deliberates about the invariable. Therefore the calculative is one part of the faculty which grasps a rational principle" (1139a: 10-15). According to Aristotle, scientific investigation deals with unchanging (invariable) first principles and the calculative with the variable aspects of the universe.

Aristotle thinks that the soul can possess the truth, through the intellectual virtues, in the following five ways: art, scientific knowledge, prudence, philosophic wisdom, and intuition. Involving the scientific, Aristotle said, "Scientific knowledge is judgment about things that are universal and necessary, and the conclusions of demonstration, and all scientific knowledge, follow from first principles (for scientific knowledge involves apprehension of a rational ground)" (1140b: 30-35). Aristotle sees science as a tool to explain known universals and in turn discover first principles not previously known to

human kind. This statement supports an *a priori* foundation for scientific investigation and is virtuous due to the application of reason in the process of discovery.

In the *Nicomachean Ethics*, Aristotle suggests that intuitive reason is what grasps the first principles and "Therefore wisdom must be intuitive reason combined with scientific knowledge" (1141a: 15-20). Aristotle insists that humans cannot apprehend the first principles by practical wisdom, scientific knowledge, and philosophical wisdom. He then said, "the remaining alternative is that it is *intuitive reason* that grasps the first principles" (1141a: 5). Aristotle then makes a connection between the above definition and philosophic wisdom that can produce happiness (by the exercise of philosophical reason). Aristotle realizes that wisdom is the most accurate of all. Prudence is considered a virtue that allows the soul to form opinions and provides a means to go from knowledge to the more superior level of wisdom where both the moral virtues and intellectual virtues reign supreme. In Aristotle's view, both moral and intellectual virtues are required for an individual to obtain the ultimate state of happiness. This is because it takes both understanding and a good character to fulfill an individual's purpose. This purpose involves the activities of the soul that can move us along on the path to happiness.

Irrational soul. The Irrational Soul was thought to be comprised of the Metabolic Soul that relates to health and the Appetitive Soul where the habits of good character are cultivated. Moral virtues emerge with the proper control of the desires and passions that flourish within the appetitive soul. Aristotle believes that intellectual wisdom does not always lead to good moral character because of the powerful influence of the appetitive segment of the irrational soul.

Moral virtues. While Aristotle considers the intellectual virtues as superior to the moral virtues, he spends more time in the *Nicomachean Ethics* on the moral virtues. Aristotle believes that the moral virtues deal with states of character (dispositions towards the capacity to feel, that is to the particular appetite) and that passions have a large influence on one's character. Instead of utilizing the facility of reason, passions arise and dissipate within the controlling force of pleasure and pain. According to Aristotle, all of the virtues are influenced by pleasure and pain. Thus, pleasure and pains are factors in the ongoing development of one's character. Aristotle notes, "Again, if the virtues are concerned with actions and passions, and every passion and every action is accompanied by pleasure and pain, for this reason also virtue will be concerned with pleasures and pains" (1104b: 10-15).

Aristotle sees passions, in contrast to reason, as the primary influence for our moral state. He believes that moral virtue is not innate nor a product of philosophical reasoning. Aristotle's vision of moral virtue is that of a state of character, grasped by perception, representing the good characteristics of a person. Aristotle reminds us that these human attributes are resident in the Appetitive part of the Irrational Soul.

Aristotle provides a definition of virtue as an intermediate state of mental disposition between two vices represented by deficiency and extreme ranges of action. In defining the states of character that form moral virtue, Aristotle states that, "moral virtue comes about as a result of habit" (1103a: 15-20). Aristotle continues with the remark, "If then, the virtues are neither passions nor facilities, all that remains is that they should be states of character" (1106a: 10). Before leading into the specific moral virtues, Aristotle describes the range of thoughts that signifies the virtue state. Aristotle said, "Virtue must

have the quality of aiming at the intermediate. I mean moral virtue; for it is this that is concerned with passions and actions, and in these there is excess, defect, and the intermediate" (1106b: 15). He continues his thoughts with the statement, "Virtue, then is a state of character concerned with choice, lying in a mean" (1107a: 1-5). Concerning the intermediate, Aristotle said, "Now it is a mean between two vices, that which depends on excess and that which depends on defect" (1107a: 1-5). The virtues are not actions. They are irrational states of character. Therefore, Aristotle sees moral virtue as an activity of the appetitive segment of the irrational soul that is habitually disposed to the mean range rather than the extreme ranges of the capacity to feel the core appetite at issue. Aristotle specifically describes eleven moral virtues in the ethics.

In this theory, vices and virtues have a direct relationship with one's state of character and level of morality. In describing vice and virtue, Aristotle remarks, "excess and defect are characteristics of vice, and the mean of virtue" (1106b: 30). Not all means can be classified as virtue since some actions are never virtuous regardless of their location between excess and defect. Aristotle believes that the choice of good actions is reinforced by proper upbringing, habit, and the exercise of doing right. One example of virtue is friendliness. This virtue represents a mean between being grouchy on one end and people pleasing on the other end. Aristotle's concept of moral virtue is illustrated in figure G.2.

Figure G.2

Aristotle's Virtue Concept

Defect (vice)----------Intermediate (virtue)----------Excess (vice)

Grouchy----------Being Friendly----------People Pleasing

Aristotle examines eleven virtues in the *Nicomachean Ethics*. These are courage, temperance, generosity, magnificence, magnanimity, right ambition, good temper, friendliness, truthfulness, wit, and justice. These virtues along with the twenty-two associated vices provide the cornerstone for Aristotle's virtue ethics theory. Aristotle describes each of these virtues much like the above discussion involving the virtue of friendliness. In the *Nicomachean Ethics*, Aristotle spends more time with the moral virtues because he insists that these virtues, within the scope of the Appetitive Soul, are more difficult to control due to the weakness of the will and lack of good habits. Aristotle regards the formation of habits by practicing a virtuous life as the key to building good character. Aristotle believes that we acquire virtues by forming good habits, and that acting virtuously is a function of human beings on the path to the ultimate good. While Aristotle emphasizes the moral virtues largely in the *Nicomachean Ethics*, he understood the intellectual virtues to be closer to the ultimate good (happiness) because of the required exercise of reason that is needed to achieve a level of happiness that represents the highest good. Aristotle sees the virtue of justice as the peak of virtue because he felt that the moral and intellectual virtues are a prerequisite to justice.

Virtue ethics: guidelines for the attainment of the good. Aristotle believes that it takes both the moral virtues that form an individual's state of character along with the higher intellectual virtues for one to attain the ultimate good of the human soul. According to Aristotle, the ultimate good represents a goal attained only by developing a good character through the control of the appetitive soul (passions) and the development of the rational soul (reason) to an individual's full potential. Since the virtues are both moral and intellectual, actions associated with the development of a good character represents

the path to happiness, which is the overall purpose of life. Therefore, Aristotle advocates an active life of study, practical understanding, and political involvement along with an effort to control the passions from which moral virtues and vices emerge.

With the human capacity of reason, the person is in charge and not subject to either reason or the appetitive soul exclusively. The concept of "total self" becomes known from a synthesis of the irrational and rational parts of the soul. Virtue ethics emerge from the structure of the human soul by living the 'good' life and providing the essential components for one's ultimate purpose of life. The ultimate state of happiness is derived from living a good life. Living a good life emerges out of living well. Living well sits on the foundation of ethics. Thus, ethics provide direction for a purposeful, fulfilling, and happy life. Happiness involves the cultivation of the moral and intellectual virtues, along with an understanding one's goal and purpose in life. In the *Nicomachean Ethics*, Aristotle places a primary emphasis on the moral and intellectual virtues. These virtues provide the primary substance for the development of his virtue ethics theory.

Justice

Aristotle considers the virtue of justice to be the peak of virtue. The concept of justice unifies and orders the lesser virtues. Aristotle believes that the actions of people in pursuit of perfection are directly related to the concept of justice. While in a narrow sense, justice is a mean between two extremes of unfairness; in a larger context, justice is the whole of virtue. Aristotle notes, "Justice in this sense, then, is not part of virtue but virtue entire…" (1130a: 5-10). Aristotle believes that the practice of justice was a mix of two parts: natural and legal. Natural justice was seen as being eternal, unchanging and universal. He sees Legal Justice as being according to human law. According to

Aristotle, human law is only an imperfect reflection of the eternal light of Natural Justice. The relationship between legal justice and the concept of goodness is derived from the ultimate source of justice, which is inherent to human nature and originates in Natural Justice. The *a priori* goodness of Natural Justice presupposes the good aspects of legal justice.

Concerning the virtue of Justice, Aristotle makes the remark, "Of political justice, part is natural, part legal – natural, that which everywhere has the same force and does not exist by people's thinking this or that" (1134b: 7-25). In a continuation of his comment concerning Natural Justice, Aristotle said, "nature is unchangeable and has everywhere the same force" (1134b: 25). Aristotle summarizes Legal Justice, "Similarly, the things which are just not by nature but by human enactment are not everywhere the same…" (1135a: 1-5). The amount of true justice in our human laws has a direct relationship to the degree by which it correlates with Natural Justice. This is why the field of Ethics can have such a profound impact on the moral standing of human laws.

Concluding remarks

During the fourth century B.C., Aristotle provided humankind with an ethical framework that remains sound even in our modern technological era of the twenty-first century. Aristotle pinpoints the essence of human nature by constructing a framework for understanding human psychology. He describes the strengths and weaknesses that are associated with being human and formulates an ethical model that endures throughout the ages. He distinguishes between various human endeavors and provides, through his understanding of humanity, an "algorithm" for attaining Earthly happiness. Aristotle's insights into the nature of humanity and the importance of virtue ethics were well thought

out and enlightening. Many of his observations concerning the function, purpose, and goal of human beings have withstood the test of time and will remain significant as the process of understanding the human experience continues in the vast future.

Over a thousand years later, St. Thomas Aquinas utilized Aristotle's theory as a basis for his Christian natural law approach to ethics. Kant took the *reason* path in the philosophical road in the development of the categorical imperative principle. The proponents of the utilitarian model of ethics took the *empirical* path. While the utilitarian theory provides the standard model for moral decision-making in today's world, only virtue-ethics allows for the character of an individual, with sufficient room for exceptions, to guide the actions of an individual. The ultimate good that Aristotle emphasizes in the *Nicomachean Ethics* has a direct relationship to the concept of integrity. Integrity involves being complete, of sound moral principle, and being in perfect condition. In the tradition of Plato, Aristotle develops this "idea of the good" as a goal and challenge for future generations. Aristotle went further than Plato's concept of "The Good" to develop a framework for the attainment of that ultimate state of goodness. A road that leads to happiness is paved with virtues and provides a solid foundation for the use of one's character in moral decision-making.

Appendix G

Aquinas' Christian Natural Law

Introduction.

During the thirteenth century, St. Thomas Aquinas developed a theory of ethics primarily based on Aristotle of the fourth century B.C., the Christian Bible, and St. Augustine of the fourth century of our current era. Thomas Aquinas' work was built upon a platform of Aristotle's concept of the eternal nature of natural justice and the les-perfect notion of legal justice. Since it is important to understand Aristotle's worldview to fully comprehend Aquinas' concept of natural law, Aquinas' theory represents an addition to Aristotle's contribution. Aquinas took the concepts of natural and legal justice and blended them with the Christian virtue of Faith to transform the ancient concept of virtue ethics into a theory that works well for Christians and non-Christians as we begin this new era of human history in the twenty-first century.

Aquinas' concept of natural law paralleled Aristotle's notion of natural justice, however had the added dimension of being part of the eternal law of God. Aquinas refers to Aristotle's legal justice as human law. Therefore, Aquinas' concept of law was to place Aristotle's natural and legal justice within a Christian context incorporating both the eternal law of God and the divine law known through Faith. Aquinas' concept of law was developed from a synthesis of Aristotle and Augustine's writings (Aquinas, trans. 1956/1998). Aquinas classified law into four distinct types: natural, eternal, divine, and human. The concept of natural law is very similar to Aristotle's notion of natural justice since both theories are based on the use of human reason to grasp the self-evident universal principles that con be known to all human beings. Fox (2003) noted, "Some

follow immediately from the primary, and are so self-evident that they are reached without any complex course of reasoning" (p. 5). Aquinas sees natural law as being influenced by the eternal law of God and by the Divine Law (Faith) as revealed to us through the Christian Bible through the natural reason of human beings and truth derived by Faith within the realm of divine law. Aquinas describes human law (positive law) as the application of natural law to specific cases in a way much as Aristotle described legal justice.

During the dark ages, Greek scholars fled into territories later conquered by the Arabs where Aristotle's writings were preserved in the great Islamic mosques for future generations. Hergenhahn (2001) mentioned, "These scholars carried with them many Greek works of art and philosophy, among them the works of Aristotle" (p. 68).

The Christian influence in Aquinas's views was primarily from St. Augustine and the disciples of the new testament of the Christian Bible. In cases of both Aristotle and Augustine, Aquinas was referring to material over a thousand years old in the development of this treatise on law found in questions 90-97 of the monumental work, *Summa Theologica*. Aristotle's *Nicomachean Ethics* appeared during the fourth century B.C. and Saint Augustine's work, *On Free Choice of the Will*, emerged out of the Roman Empire less than a century after Constantine had made Christianity the official religion of the state (Augustine, trans. 1964/1985). The following sections provide a description of Aquinas' framework with a particular emphasis on eternal and divine laws, the structure of natural law, and the significance of natural law.

The basis of natural law: eternal and divine laws

Concerning eternal law, Augustine (trans. 1964/1985) said, "To put in a few words, as best I can, the notion of eternal law that has been impressed upon our minds: it is that law by which it is just that everything be ordered in the highest degree [ordinatissima]" (p. 15). Aquinas saw eternal law as being governed by divine reason (God) and all encompassing throughout the universe. This law bears the character of law and governs the universe through divine reason. It is eternal and unchanging. It encompasses physical, moral, and revealed religious laws. Natural law is then seen as the subset of eternal law that the rational being can know through natural reason. Our participation in natural law allows only a mere glimpse into the dimension of divine reason where the secrets of the universe are contained.

The second law described by Aquinas was Divine Law. The Divine Law, known through Faith, pertains to our supernatural end (eternal life). It is the Biblical law given by God. The Divine Law is made up of the old law dealing with punishment and the new law pertaining to love and heavenly goodness. These laws correspond with the old and new testaments of the Bible. The Divine Law extends Aristotle's concept of happiness to an eternal level beyond the Earthly context found in the *Nicomachean Ethics* to the plateau of eternal happiness with God. Human participation in natural justice results from the divine law being presented to us through revelation and Faith being combined with human reason. This participation in natural law provides sound ethical guidance for our moral decision-making that represents an important aspect in character development.

The structure of natural law

Aquinas described natural law as the revelation of eternal law within the world around us that applies to human choices. Concerning the natural aspect of this law of

conduct, Fox (2003) maintained, "There is then, a double reason for calling this law of conduct natural: first, because it is set up concretely in our very nature itself, and second, because it is manifested to us by the purely natural medium of reason" (p. 2).

Law can be defined as the rules of conduct enforced by legislation or some form of authority. While Aquinas used the term human law to describe legislation specific to the human experience, the authority aspect is purely Christian with eternal law governing the universe through divine reason and divine law obtainable through the holy scriptures of the Christian Bible. Thus, natural law, known through natural reason, is that part of eternal law that encompasses human nature. To Aquinas, the essence of natural law is ethics. Aquinas sees the ancient concept of ethics instilled in human nature within the overall framework governed by both the eternal and divine laws of God. Natural law is made up of first principles that are self-evident truths that can be known to all through natural reason. These universal truths are the same for everyone. With both reason and Faith, this concept allows the rational creature to participate in the eternal law of the universe. Aquinas (trans. 1956/1998) presented the concept of natural law as, "Wherefore it has a share of the eternal reason, whereby it has a natural inclination to its proper act and end: and this participation of the eternal law in the rational creature is call the natural law" (p. 15). Natural law with its foundation in the eternal and divine laws of God, is seen as the ultimate moral law that allows for the standardization of our knowledge of good and evil.

The notion of natural law provides an eternal platform that allows for a universal set of ethical standards that transcend religious and cultural boundaries. Aquinas believes that God's law that prescribes our conduct is found in nature. Concerning the rules

within nature, Fox (2003) explained, "Those actions which conform with its tendencies, lead to our destined end, and are thereby constituted right and morally good; those at variance with our nature are wrong and immoral" (p. 1). When the Christian element of Aquinas' theory is removed, the concept of human nature being inherent to natural law remains acceptable regardless of teleological perspective. The universality of natural law is what provides the consistency that is the hallmark of virtue ethics.

Aquinas (trans. 1956/1998) talked about the imprint of the Divine light on us and reiterated, "It is therefore evident that the natural law is nothing else then the rational creature's participation of the eternal law" (p. 16).

Aquinas describes the nature of natural law in more detail with the use of specific questions concerning its essence. Natural law was then described as something appointed by reason and not a habit. Aquinas' notion concerning the use of reason corresponds with Aristotle's concept of the rational part of the human soul. However, Aquinas' view that virtues are attained through reason is in contrast to Aristotle's understanding that forming good habits were essential for the attainment of moral virtue. He went on to say that natural law has several precepts with the primary one being, "Hence this is the first precept of law, that good is to be done and ensued, and evil is to be avoided" (Aquinas, trans. 1956/1998, pp. 59-60). Aquinas believed that there are aspects of natural law that we share with other animals. For man, he believed that all other precepts were based on the first precept of law.

Aquinas insists that all virtuous acts were part of natural law and all sin is in opposition to natural law. While knowledge of right and wrong is ever present in natural law, the free will human attribute provides the determining factor in the selection of sin in

contrast to virtue. The presence of sin results directly from the capacity of human reason to choose wrongly. Concerning the question of whether natural law is universal for all humankind, Aquinas noted that in a general sense it is the same for all but could vary at the detail level due to problems associated with individual reasoning. Aquinas elaborated on this in the fourth article of question 94:

> Consequently, we must say that the natural law, as to general principles, is the same for all, both as to rectitude and as to knowledge. But as to certain matters of detail, which are conclusions, as it were, of those general principles, it is the same for all in the majority of cases, both as to rectitude and as to knowledge; and yet in some few cases it may fail, both as a rectitude, by reason of certain obstacles (just as natures subject to generation and corruption fail in some few cases on account of some obstacle), and as to knowledge, since in some the reason is perverted by passion, or evil habit, or an evil disposition of nature; thus formerly, theft, although it is expressly contrary to the natural law , was not considered wrong among the Germans, as Julius Caesar relates. (Aquinas, trans. 1956/1998, pp. 66-67)

Concerning the changeability of natural law, Aquinas believes that natural law is unchangeable in its first principles but can be changed by addition and subtraction in its secondary principles. Aquinas (trans. 1956/1998) said, "But it may be changed in some particular cases of rare occurrence, through some special causes hindering the observance of such precepts…" (p. 69). This section can provide the justification for exceptions in cases where reason associated with the specifics of a situation override natural law to

obtain a greater level of justice. A moral theory has to be both firm and flexible enough to handle the complex nature of human situations where adherence to strict normative rules can result in unethical behavior under certain conditions. Fox (2003) remarked:

> To the first class belong those, which must, under all circumstances, be observed if the essential moral order is to be maintained. The secondary principles are those whose observance contributes to the public and private good and is required for the perfection of moral development, but is not so absolutely necessary to the rationality of conduct that it may not be lawfully omitted under some special conditions. (Fox, 2003, p. 3)

In the final remark concerning natural law, Aquinas insisted that the natural law cannot be blotted out of the hearts of man. He went on to say that the most general precepts that are known to all cannot be blotted out but certain secondary precepts can be due to the hindrance of reason in applying the general principles to particular situations. Concerning the nature of change in natural law, it is important to add the specifics of a given situation to the hindrance of reason. Then the exceptions that are characteristic of the human experience can be handled in an effective and ethical manner.

The significance of natural law

The main strength of natural law theory is the universality of application. The natural law framework works well for both Christians and non-Christians. The concept of natural law can be seen with the Faith element supported by Divine Law. It makes sense that the laws of ethics are on an equal footing with the laws of science. With the natural law approach, both are part of the eternal clockwork of the universe. The notion

of eternal truths and order in the universe corresponds in a very effective manner to the natural law approach to human understanding.

Concluding remarks

During the thirteenth century, Saint Thomas Aquinas developed a massive publication entitled the *Summa Theologiae*. He treatise on law (Questions 90-97) provides not only a synthesis of older ideas but lights the way for a better understanding of the nature of law from both the eternal and human perspectives. Aquinas' work was influenced by Aristotle and Augustine, an early Christian of the Roman Empire. Aquinas's thoughts concerning the nature of law has allowed for the integration of Faith to the observations of Aristotle concerning human morality and expands the notion of the ultimate good from a pure Earthly phenomenon to the supreme level of eternal happiness. Concerning virtue ethics, Artz (1994) stated, "Virtue ethics personalizes ethical decisions by making the individual's character the basis for moral evaluation" (p. 20). While over seven hundred years old, the natural law theory of ethics provides a character-based philosophy that remains, even for our time, a very solid and stable framework for moral decision-making.

Appendix H

Categorical Imperative

Introduction

Philosophers of the eighteenth century produced many essays on the subject of ethics. Immanuel Kant's theory stands out as a significant contribution to the understanding of the nature of ethics. In *Fundamental Principles of the Metaphysic of Morals* (1785), Kant discusses the nature of morality and how ethics can be used in everyday situations such as those faced by computer science professionals in database technology.

In this paper, the author has highlighted Kant's ethical theory. The Categorical Imperative lies at the center of his contribution to the field of ethics. In section III of this paper, the researcher examines the problematic issues that are associated with Kant's theory. The final section provides a link between Kant's theory and the computer science field. Following a brief examination of computer ethics in general, the database area of computer science becomes the focus. Various ethical issues including database privacy and responsibility will be addressed within the light of an understanding of the normative principles associated with the Categorical Imperative construct.

The nature of deontological theories

Baase (1997) suggested: "Deontologists tend to emphasize duty and absolute rules, to be followed whether they lead to good or ill consequences in particular cases" (p. 334). As a deontologist philosopher, Kant believed that reason determines ethical behavior and provided a methodology for the determination of the standards for what is good and right. The principle of universality is characteristic of deontological thinking.

This universality, supplemented by reason, places a right or wrong label on particular actions regardless of the situations involved.

The importance of reason

In a slightly different stance within the tradition of the enlightenment, whereby empirical evidence is disregarded, Kant used pure reason as the exclusive means for access to the a priori universal principles of right and wrong. Kant utilized the notion of a "rational being" throughout his theory. Kant considered the concept of reason in conjunction with the autonomy of the will to provide the foundation for morality in human kind. Kant's use of the term "rational being" can be thought of in a context beyond human beings to the Divine, other life in the universe, and to the arena of artificial intelligence. This broader scope was discussed in a recent book entitled *Morality and Machines:*

> Kant's dealing with rational beings, rather than just human beings, makes the theory more universal than other theories, and broad enough that it could encompass artificially intelligent entities, should the need for consideration of moral duties toward them (and of them toward us) ever arise. (Edgar, 1997, p. 65)

It is interesting that higher forms of reasoning (philosophical reasoning) were not required for the effective activation of the Categorical Imperative. According to Kant, the most common of reasoning, as found in common sense, was sufficient for participation in the select group worthy of moral consideration.

The universality and a priori nature of ethics

Angeles' (1981) philosophical dictionary defined *a priori* as, "Prior to and independent of sense experience" (p. 17). Kant believed that our participation in pure reason provided the key to access an a priori set of standards to determine whether a specific action is right or wrong. Given the specifics of a situation, the universality of this determination results from the notion that the same right and wrong conclusion would remain constant for all rational beings.

Baase (1997) defined the principle of universality as, "We should follow rules of behavior that could be universally applied to everyone" (p. 334). According to Edgar (1997), Kant insisted that moral law must be a priori because, "experience and observation will not always be able to give us the criteria for the morality of actions" (p. 61).

In the tradition of Aristotle, Kant's theory supported the existence of a universal set of ethical standards (a priori through pure reason), but did not list any specific instances of virtues and vices. Kant's theory was situation driven in a top-down fashion from particular actions, the reason-autonomy process, and finally to the ultimate source of right or wrong decisions. His theory of ethics provided a level of consistency that tends to prevent the eroding of ethics. The universality foundation for ethical decision-making provides the strict consistency that is inherent to this theory.

Good will, free will, autonomy, freedom, and duty. In addition to reason, the concept of a free will provides the necessary elements for understanding morality. Kant (1785) considered a good will as something that is "good in itself" (p. 5). Kant stated, "a good will appears to constitute the indispensable condition even of being worthy of happiness"

(p. 4). Kant uses this concept of a good will to develop his ideas of a free will, duty, and the notion of a Categorical Imperative.

Kant described moral perfection as reason framed *a priori* along with a free will. Palmer (2001) explained that, "By posting freedom as it were grounded in a synthetic a priori truth (for without freedom there can be no moral acts), one can derive an ethical code from its foundation in reason" (p. 215). Free will provides the basis for human choice. Human choice along with reason forms the foundation for morality in humankind. Johnson (2001) stated, "for we could not be moral beings at all unless we had this rational capacity" (p. 45).

Hypothetical imperative

The focal point of Kant's theory of ethics revolves around the concept of a Categorical Imperative. The two types of imperatives discussed in the *Metaphysic of Morals* were labeled as hypothetical and categorical. The former pertains to actions done for some end other than itself. Kant (1785) stated, "If now the action is good only as a means to something else, then the imperative is hypothetical" (p. 17). Many of our actions are driven by some reinforcement such as money or phrase. Throughout the twentieth century, the people who were associated with the behaviorist school of psychology advanced this concept even further.

While both imperative versions lead to good, only the Categorical Imperative commands a certain behavior immediately. Kant believed that the Categorical Imperative formed the absolute substance of morality. In the *Metaphysic of Morals* (1785), Kant mentioned that, "This imperative may be called that of morality" (p. 18).

Categorical imperative: the formula of the universal law of nature

According to Kant (1785), the single Categorical Imperative of morality was given as, "Act only on that maxim whereby thou canst at the same time will that it should become a universal law" (p. 21). Two of the formulations suggested by Kant were the formula of the universal law of nature and of humanity. Kant summarized the universal law of nature form of the Categorical Imperative with the statement, "Act as if the maxim of thy action were to become by thy will a universal law of nature" (Kant, 1785, p. 22). For any given situation, one should determine the universality of a proposed act and then act accordingly based on the return value supplied by the Categorical Imperative function. If the universality test fails, then one should proceed, without exception, to some other course of action that is in accordance with the output of the Categorical Imperative. According to Kant, the universality test must rely solely on pure reason without any interference from empirical sources. Thus, the source of morality rests not in some standard set of universal virtues, but on the facility of reason.

If a particular action can become a universal law, then the action becomes consistent across the spans of space and time. This consistency leads to the summit of certainty that Kant believed was necessary for the establishment of a foothold for morality.

The humanity formula

Kant (1785) described the humanity formula as, "So act as to treat humanity, whether in thine own person or in that of any other, in every case as an end withal, never as means only" (p. 26). This form of the Categorical Imperative has implications for all areas of human endeavor including those found within the computer science discipline.

It is important to note the use of "only" in the above imperative. For instance, Kant does not see a problem when employees are paid a fair wage for providing a means to some end for the sake of a particular company. The humanity formula has a strong connection to respecting human dignity and preventing harm to others. If all aspects of our human society followed this version of the Categorical Imperative, our world would be a better place to live.

Kant saw the formulas as being equivalent in the moral determination of a specific action. He believed that all of the formulations lead to the same overriding Categorical Imperative.

The lack of a set of virtues

In *The Nicomachean Ethics*, Aristotle (trans. 1941) provided an effective foundation for the theory of virtue ethics. Aristotle distinguished moral virtues from intellectual virtues based on his observation of human behavior. Through this effort, Aristotle provided a means for the identification of virtues from their opposing vices.

In contrast to Aristotle's virtue ethics approach, the *Metaphysic of Morals* provided no specific instances of virtues and vices. With Aquinas' later adaptation of Aristotle's virtue ethics foundation, the formulation of virtue ethics based on the concept of natural law found support in the Christian community. While Kant saw human reason as being sufficient, the lack of an identified set of universal standards of right and wrong provides insights into one of the flaws of Kant's theory. Edgar (1997) mentioned, "the Categorical Imperative has no moral content, and so could be used to universalize evil, or for trivial examples, such as 'tie your shoes,' which are not moral" (p. 65).

The complete reliance on reason

The complete reliance on individual human reason places the ultimate moral authority on each individual instead of a true a priori set of ethical standards. While the notion of pure reason is good, the flaws of individual human reasoning, even in the realm of common sense, are not accounted for in Kant's theory. The purity of an individual's reason could be adversely affected by empirical sources.

The "no exception" problem

The "no exception" problem represents the main area of concern in the Categorical Imperative theory. Kant emphasized the importance of the universality concept in the formation of the Categorical Imperative. He believed that without the principle of universality, the stability of moral decision-making would be placed in jeopardy. This theory ignored the possibility of the morality of a specific act being contingent on the circumstances surrounding the act. Again, Edgar (1997) noted, "it is difficult to find maxims of action that can be universalized without exception" (p. 65).

While several flaws are evident, the idealized principle of the Categorical Imperative is good and the concept has made a significant contribution to the field of Ethics.

Implications for computer ethics in general

The interaction between computers and people has been a focus of scholarly activities for several years. Most of the research has been in the area of human-computer interaction encompassing the user-interface design aspects of computer science. There has been a gradual increase in computer ethics related literature within the computer science community since 1985. Some of the focus in the computer ethics literature since 1985 has been directed toward Kant's ethical theory.

The impact of computer technology extends from programmers, analysis and database experts to internal users, customers, and shareholders. The action performed by technical people has an effect on many other individuals and this effect may extend for life of the database or software product. Sometimes the action can have a profound effect resulting in harm.

An understanding of the Categorical Imperative provides a means to determine if one's action is right not merely from future consequences, but from an inward examination at the core of an individual's character. Kant provided a very general theory that is not limited to certain situations, but is applicable to moral decision making across the spectrum of human activities. This includes the technical decisions that computer professionals make on a daily basis. The reflective element that is characteristic of the Categorical Imperative approach provides a means to help ensure the integrity of technical-related actions.

Implications for the database area of computer science

Database technology has become an even more important aspect of our information society with the growth of the Internet. Databases contain personal information involving our identity, finances, bioinformatics, and psychological makeup. There is a great deal of sharing of information among databases and many times the information provides a means to more money and power.

Many of the actions resulting from these transactions cannot be universalized in accordance with Kant's Categorical Imperative principle. Some actions would be rejected because reason would not dictate them as being worthily of being among right and just acts. With the knowledge of Kant's theory, it becomes the duty of database

professionals to think before acting and not fall prey to the injustice of wrong actions.

The "use of human beings as ends and not merely as means" version of the Categorical Imperative emphasizes the importance of human dignity. This emphasis on human dignity should be a vital consideration in the workplace. In the area of information sharing, it would be good if the shared information provided benefits for the individual in question in contrast to being used for some other end.

An awareness of ethical issues is important in the early stages of database design. A high level of data duplication results from an ineffectively designed database. The data duplication problem is resolved with the effective application of process known as normalization. When database tables are not in third or greater normal form, attributes can be stored in multiple tables resulting in a lack of integrity when a subset of the tables containing the specific data are changed. This loss of data integrity harms not only the users of the data, but the current and future technical people as well. The stress level for the programmers is elevated because of the need to correct data inconsistencies and the additional maintenance programming. The only real solution is to incur the expense of redesigning the database. This redesign involves both the restructuring of database tables and changing corresponding programs.

In the emerging area of data mining, it is important to treat people as an end in contrast to treating people as a means only. To address the ethical issues of privacy and other sensitivities, Fule and Roddick (2004) proposed an automated alert system for database administrators regarding data misuse. The Categorical Imperative provides guidance for the determination of the sensitivity levels within this proposed system.

The utilization of the Categorical Imperative can have an important impact on such database issues as privacy, informed consent, discrimination, property rights, information preservation, and in maintaining the human dignity of all of the people affected by the massive level of digital representation of information stored in modern database environments. The concept of responsibility becomes a major issue when database technology is utilized within a moral framework that protects the dignity of all involved.

Concluding remarks

As with Aristotle, Kant's contribution continues to influence the field of moral philosophy especially in such applied areas as computer ethics. An analysis was made into the nature of the Categorical Imperative principle, which represented the focal point of Kant's theory. Some of the problems associated with the Categorical Imperative theory were discussed. The lack of any room for exceptions was mentioned as being one of the most obvious concerns.

The computer science area relating to database technology was examined in light of Kant's contribution. The notion of responsibility emerged out of Kant's theory as a key element in maintaining a sufficient level of moral discourse within the critical area of computer science known as database management.

Appendix I

John Stuart Mill's Utilitarianism

Introduction

Our modern society operates primarily within a utilitarian belief structure where the consequences of our actions form the basis for moral decision-making in contrast to the inner nature of our character. The theory was developed from work done during the period of ancient Greece and the eighteenth century era of the enlightenment. In the tradition of Epicurus (c. 341-271 BC) and Jeremy Bentham (1748-1832), John Stuart Mill (1863/1993) insists that, "Actions are right in proportion as they tend to promote happiness; wrong as they tend to produce the reverse of happiness" (p. 144). The capstone of the utilitarian movement was placed in the nineteenth century by John Stuart Mill's small book entitled *Utilitarianism*. Mill expanded the notion of happiness from individual pleasure to include the higher pleasures of the mind. Additionally, Mill agrees with Bentham in transforming the scope of pleasure from the individual level to society as a whole.

The influence of the Utilitarian movement is evident in all aspects of our modern society including business, science, and political decision-making. Johnson (1985/2001) describes how utilitarianism is derived from the concept of utility with the statement, "According to utilitarianism actions, rules, or policies are good because of their usefulness (their utility) in bringing about happiness" (p. 36). Within this context, utility represents the degree of usefulness of a plan, action, or policy in bringing about happiness, an intrinsic good that has value independent of utility. Instrumental goods are

actions that lead to happiness and are not valued for their own sake but because they lead to the ultimate intrinsic human good (happiness).

This paper begins with an examination of the emergence of utilitarianism during the eighteenth century with a focus on Hutcheson, Hume, and Bentham. Additionally, this first section looks at the hedonistic roots of utilitarianism beginning with Epicurus of the ancient Greek period. The paper then shifts to the contributions of John Stuart Mill during the nineteenth century where the notion of pleasure was expanded into the greater concept of happiness. Next, a comparison is made between Mill's notion of utilitarianism and Aristotle's virtue ethics. Finally, the paper addresses some of the problems and ambiguities found in the modern conception of utilitarian ethics.

Eighteenth century empiricism

The issues of pleasure and pain are reflected in ethical writings throughout the history of western civilization especially during the eighteenth and nineteenth centuries. During the eighteenth century, the emphasis on individual pleasure was expanded to extend beyond the concept of self. The "Greatest happiness for the greatest numbers" principle appears in the literature as early as 1725 (Hutcheson, 1725/2004). The term "utility" was introduced in Book III concerning morals within, *A Treatise of Human Nature* (Hume, 1740/1984). Concerning the principle of utility, Hume (1740/1984) remarked, "The utility and advantage of any quality to ourselves is a source of virtue…" (p. 647). In a later work entitled, *An Inquiry Concerning the Principles of Morals*, Hume (1752/1957) devoted an entire section to the topic of why utility pleases (pp. 40-58). In this section, Hume describes the importance of utility:

> If usefulness, therefore, be a source of moral sentiment, and if this usefulness be not always considered with a reference to self, it follows that everything which contributes to the happiness of society recommends itself directly to our approbation and good will. Here is a principle which accounts, in great part, for the origin of morality: and what need we seek for abstruse and remote systems when there occurs one so obvious and natural? (Hume, 1752/1957, p. 47)

Jeremy Bentham (1748-1832) is considered one of the founders of Utilitarianism. Much of this theory, based on the greatest pleasure principle, is presented in *The Principles of Morals and Legislation* (Bentham, 1781/1988). The first sentence in his 1781 book was, "Nature has placed mankind under the governance of two sovereign masters, pain and pleasure" (Bentham, 1781/1988, p. 1). In the tradition of hedonism, Bentham believes that human behavior is motivated by pleasure and pain. In an *a priori* tone, he sees pleasure as good and independent from the specific interests of the person acting. In describing the underlying principle of utility, Bentham expanded the utility concept from the scope of individuals to society in general, with the statement:

> By the principle of utility is meant that principle which approves or disapproves of every action whatsoever, according to the tendency which it appears to have to augment or diminish the happiness of the party whose interest is in question: or, what is the same thing in other words, to promote or to oppose that happiness. I say of every action whatsoever; and therefore not only of every action of a private individual, but of every measure of government. (Bentham, 1781/1988, p. 2)

Concerning the principle of utility, Bentham focused on actions that promote the general happiness (maximize pleasure and avoid pain). He saw any action that does not maximize the greatest happiness as morally wrong. Bentham believes that one could confirm the principle of utility by observation. He stresses a scientific approach to connecting morality with the consequences of human action. His "calculus" for moral decision-making is based on the "Greatest pleasure for the greatest numbers" principle. With the greatest pleasure principle, Bentham expands the role of utilitarianism from maximizing individual pleasure to the greatest pleasure for society as a whole. Bentham suggests that measurements of the quality (duration) and quantity (intensity) of pleasure-pain factors provide data for the scientific proof of utilitarianism. Bentham's measures are all designed to quantify, in order to produce a scientific measurement. Bentham combined empiricism and rationalism to emphasize deductive argument.

He believes that the distinguishing factor between utility and other systems of morality is the association of the principle of sympathy and antipathy found in all of the other ethical theories. In his analysis of the non-utilitarian theories, Bentham stated:

> Among principles adverse to that of utility, that which at this day seems to have most influence in matters of government, is what may be called the principle of sympathy and antipathy. By the principle of sympathy and antipathy, I mean that principle which approves or disapproves of certain actions, not on account of their tending to augment the happiness, nor yet on account of their tending to diminish the happiness of the party whose interest is in question, but merely because a man finds himself disposed to approve or disapprove of them: holding up that approbation or

> disapprobation as a sufficient reason for itself, and disclaiming the necessary of looking out for any extrinsic ground. (Bentham, 1781/1988, pp. 13-16)

Bentham saw the other systems of morality as being less scientific and more likely to have errors. Most scholars agree that Bentham attempted to consolidate the ideas of Epicurus, Hutcheson, and Hume into a more scientific theory of utilitarian ethics. His notion of utilitarianism provides the framework for directing actions toward the greatest possible quantity of pleasure for all. Bentham's idea concerning the importance of the principle of utility provides the groundwork for John Stuart Mill's further development of utilitarianism during the nineteenth century.

The followers of utilitarianism use hedonism as their foundational approach to distinguishing right from wrong because hedonistic theory places the intrinsic good of pleasure (later shifted by Mill to the broader concept of happiness) as the ultimate human good. The emphasis on consequences of behavior that is inherent to hedonistic ethics formed a basis for later utilitarian thinking with a broader concept of happiness. Hedonism places pleasure as the highest intrinsic good in life. With this school of thought, actions are right or wrong based on whether they produce pleasure. The hedonistic roots of utilitarianism predate the fourth century BC and pertain to exclusive pursuit of pleasure. Hedonism is most associated with the Greek philosopher Epicurus (342-270 BC) who insists that we should not only maximize pleasure, but also minimize pain, which represents a balance between opposite stimuli. However, Epicurus continued to believe that the only thing intrinsically valuable is one's own pleasure. He

recommends a virtuous (needed to attain happiness), moderately self-disciplined life. In a letter to Menoeceus, Epicurus described the nature of pleasure:

> Therefore, we declare that pleasure is the beginning and the goal of a happy life. For we recognize pleasure as the first good and as inborn; it is from this that we begin every choice and ever avoidance. It is to pleasure that we have recourse, using the feeling as our standard for judging every good. (Epicurus, trans. 1993, p. 65)

The fragments of Epicurus' writings that have survived throughout the ages provide the groundwork for the utilitarian theory of ethics that not only has seen growth but also has dominated ethical thinking since the eighteenth century enlightenment.

The maturity of the utilitarian theory

In the tradition of Bentham and the other advocates of the principle of utility, John Stuart Mill (1806-1873) saw pleasure and the absence of pain as the only things of intrinsic value. To Mill, utilitarianism is grounded in a theory of life that places the acquisition of pleasure and avoidance of pain as its primary focal point. He suggests that some pleasures are at a higher level (higher pleasures) and more valuable than other pleasures (lower pleasures). For example, he sees the pleasures associated with learning and helping others at a higher level than such activities as enjoying a good meal.

Mill disagrees with Kant's intuitive view of ethics based on self-evident principles and sees ethics through inductive lenses where empirical evidence provides the foundation for morality. Therefore, Mill relies on empiricism to justify the utilitarian movement. This evidence comes from experience and observation. The consensus of experienced observers, the reflection on personal desires and social approval form the

empirical basis for utilitarianism. He maintains that the assessment of an action's consequences is more important than the motives and character traits involved. Mill rejected the virtue ethics concept and put a philosophical foundation in place for the emergence of Behaviorism in the twentieth century. Mill describes Utilitarianism as:

> The creed which accepts as the foundation of morals, Utility, or the Greatest Happiness Principle, holds that actions are right in proportion as they tend to promote happiness, wrong as they tend to produce the reverse of happiness. By happiness is intended pleasure and the absence of pain; by unhappiness, pain and the privation of pleasure. (Mill, 1863/1993, p. 144)

Mill continues to link the concepts of pleasure and pain to the ultimate end that is good in itself. Concerning the ultimate end, he states:

> According to the Greatest Happiness Principle, as above explained, the ultimate end, with reference to and for the sake of which all other things are desirable (whether we are considering our own good or that of other people), is an existence exempt as far as possible from pain, and as rich as possible in enjoyment, both in point of quantity and quality… (Mill, 1863/1993, p. 150)

Mill (1863/1993) then links the Greatest Happiness Principle with human action to formulate the utilitarian standard for morality with the statement, "This, being, according to the utilitarian opinion, the end of human action, is necessarily also the standard of morality; which may accordingly be defined, the rules and precepts for human conduct" (p. 150). Mills sees the greatest happiness principle as the first and

basic principle of ethics and the foundation of morality. Mill notes that the observation of how we strive for both our own and group happiness proves (supports) the utilitarian principle and provides insights into the nature of truth. In a discussion of how the principle of utility extends beyond an individual's happiness to others, Mill introduces the notion of a benevolent spectator (kind and good onlooker). Mill uses the benevolent spectator notion to claim that the Christian concept of the Golden Rule is an example of the utilization of utilitarian ethics. Mill (1863/1993) said, "As between his own happiness and that of other, utilitarianism requires him to be as strictly impartial as a disinterested and benevolent spectator" (p. 156). The benevolent spectator provides the proof for the transference of happiness to all concerned. This inductive proof for the support of utilitarianism relates to the evidence that people actually desire happiness:

> No reason can be given why the general happiness is desirable, except that each person, so far as he believes it to be attainable, desires his own happiness. This, however, being a fact, we have not only all the proof which the case admits of, but all which it is possible to require, that happiness is a good: that each person's happiness is a good to that person, and the general happiness, therefore, a good to the aggregate of all persons. Happiness has made out its title as *one* of the ends of conduct, and consequently one of the criteria of morality. (Mill, 1863/1993, p. 178)

While being an empirical approach, Mill is attempting to remove any reference to *a priori* principles and intuitive approaches. Mill opposes the self-evident intuitive view of ethics. In a partial agreement with the views of Aristotle, Mill places happiness as the sole end of human action. In contrast to Aristotle's character-based means to happiness,

Mill took a forward-looking approach based on empirical sources instead of a set of universal standards for right and wrong. He suggests that the means to happiness in itself provides the ethical path to morality. Mill (1863/1993) stated, "If so, happiness is the sole end of human action, and the promotion of it the test by which to judge of all human conduct; from whence it necessarily follows that it must be the criterion of morality, since a part is included in the whole" (p. 182). Virtue provides the means for achieving a level of pleasure that can result in individual happiness. Virtue is desired not for itself but for the attainment of happiness. He sees the love of virtue as one of the higher pleasures that always promote general happiness. Mill sees the cultivation of nobleness of character as one of the higher pleasures that results in the concept of human dignity. Mill touches on the importance of forming good habits when he said, "the will to do right ought to be cultivated into this habitual independence" (p. 184). Mill sees the cultivation of virtue through nurture (education) as one of the higher pleasures that not only leads to happiness but also is done because of the desire for happiness.

Mill appeals to the principle of greatest happiness only when evaluating rules of conduct. His utilitarianism focuses on moral rules in contrast to individual actions. Thus, the utilitarian principle is invoked only in the establishment of moral rules for an ethical life that can lead to happiness. These rules, developed with an understanding of the higher intellectual pleasures, focus on individual happiness, however, pertain to the broader happiness of society in general. This happiness of society in general, relates directly to the "greatest numbers" part of the utilitarian principle.

In contrast to Aristotle who viewed justice as the peak of virtue, Mill sees justice as a peak within the scope of utilitarianism. The utilitarian view of virtue is in sharp

contrast to Aristotle's notion that one's character is grounded in both moral and intellectual virtues. For Mill, the principle of utility is the determining factor in the virtues that produce a happy character. With the emphasis on utility, the process of becoming happy becomes the virtue itself as opposed to virtue leading the way to one's happiness. Aristotle sees virtue as the foundation of ethics and justice as the sum of a noble character. However, Mill focuses on the usefulness (utility) of rules in achieving happiness. At the foundation of ethics, Mill replaces virtue with utility. Therefore, actions become guided by rules supported by utility and become virtuous because of their utility in achieving happiness. An action may be viewed as virtuous in both theories. However, the scale of justice contains virtue for Aristotle and Mill measures action against utility, the sole criterion of morality.

The concept of justice, within the utilitarian framework, provides the moral justification for exception in the general application of ethics in specific situations. While not in Kant's categorical imperative, Mill provides a "back door" that can be used in specific situations. Mill sees justice as standing higher on the social utility scale. Concerning the notion of exception in the general application of ethics, Mill discusses how it could be ethical to partake in unethical behavior for some greater good such as saving someone's life. Mill suggests that what is not just in particular cases may become just in a more paramount level in the scale of social utility. Therefore, ethical exceptions can occur for the greater good. In a very elegant way, Mill describes the concept of justice:

> Justice is a name for certain moral requirements, which regarded collectively, stand higher in the scale of social utility, and are therefore of

> more paramount obligation, than any others; though particular cases may occur in which some other social duty is so important, as to overrule any one of the general maxims of justice. Thus to save a life, it may not only be allowable, but a duty, to steal, or take by force, the necessary food or medicine, or to kidnap, and compel to officiate the only qualified medical practitioner. (Mill, 1863/1993, p. 210)

Mill sees ethical truth as being empirically ascertainable. The reliance on empirical evidence through observation and experience provides the key difficulty for the theory. Scientific knowledge based on empirical sources is constantly open to criticism and revisions as new empirical evidence becomes available. While Mill understands that some social utilities are more absolute and imperative than others are, the utilitarian theory remains susceptible to the deterioration of views seen through "unethical" lenses. While claiming to be founded on the first principle of morals, the utilitarian theory lacks any constant and universal ethical footing for moral decision-making.

A Comparison with Aristotle's Virtue Ethics

While there are similar theoretical elements between Mill's version of utilitarianism and Aristotle's virtue ethics theory, such as the importance placed on intellectual reasoning, a comprehensive comparison reveals significant differences. Aristotle's theory places a high degree of emphasis on human nature where the exercise of reason is considered a virtue. For Aristotle, human nature becomes a focal point in the development of his ethical theory. While both Aristotle and Mill sees happiness as the end goal of human activity, Mill sees happiness as pleasure with an emphasis on maximizing the general happiness of all. In contrast to Aristotle's notion that action is grounded in character, Mill stresses the importance of the consequences of actions. Mill

ties virtue to the consequences of action in sharp contrast to Aristotle's argument that action should be grounded in human nature derived from the universal standard found in natural justice. To Mill, virtue is just a component of happiness and the preferences that establish the social standard are irrespective of moral obligation. Therefore, morality becomes a function of maximizing the overall pleasure. The notion of a "social standard" is at the opposite ethical pole when compared with Aristotle's unchanging universal platform.

Aristotle's theory pertains to human well-being, natural function, and the development of character through reason and habit. Mill justifies utilitarianism on an empirical basis through the observation of what people actually desire through a post-action justification where Aristotle focuses on pre-action state of character as the impetus for moral goodness.

Problems and Ambiguities

Several problems and ambiguities emerge with a critical analysis of the essence of utilitarian thinking. With this theory, intellectual pleasure becomes good only because of the utility of the mind in the process of leading to the illusive state of happiness. The process becomes more important than the goal of which is never known with certainty. One works toward the truth but never achieves the final state of happiness because the activity itself becomes equated with the goal of happiness and thus never gets completed. The activity itself does not mean complete truth. The theory lacks a definition for happiness and replaces reason with utility. Happiness becomes self-described and the broader concept of social happiness becomes bleared since no sufficient agreement on the measure of happiness exists in the theory.

In computer ethics, as in any area of applied ethics, the utilitarian model places practitioners on both sides of the fence on important moral issues because of a lack of agreement on the nature of truth. The proposed proof of utilitarianism lacks substance since it is based entirely on the flawed notion of social happiness that is a product of the greatest happiness for the greatest numbers principle.

Concluding remarks

A reoccurring theme throughout the history of the utilitarian movement has been the greatest pleasure principle. Hedonism provides a common thread in utilitarian thinking from Epicurus in ancient times to Mill in the nineteenth century. Bentham placed the theory within the context of the scientific movement of the eighteenth century. Mill broadens utilitarianism to extend beyond individual pleasure to the good of society. In the tradition of Aristotle, Mill proposes that the higher pleasures of the mind, being cultivated through education, are more valuable than the lower pleasures of the body because the intellectual pleasures provide a path to happiness. Furthermore, Mill sees the development of the higher pleasures as a key component in maintaining human dignity. Mill expands the meaning of pleasure and focuses on rules that are in agreement with the principle of utility. With the recognition of higher pleasures that correspond with Aristotle's intellectual virtues, Mill expands the concept of pleasure to the higher plane of happiness. The focus on rules emerges out of this higher notion of pleasure so happiness can become a common characteristic throughout the fabric of society. Even with its flaws, the utilitarian movement has had a profound impact on the human experience as witnessed by our modern society that operates primarily within a utilitarian belief structure.

Appendix J

Moral Stage Theory

Introduction

During the 1840s, Kierkegaard (1843) discussed the notion of three moral stages: aesthetic, ethical, and religious. He believed that the first stage involved the pursuit of pleasure. In the second, "ethics" stage, people accept responsibility for choices. The highest level places freedom within a religious context. The significance of this work revolves around the concept that human moral development may progress through stages.

During the late nineteenth century, the concept of moral stages was discussed within the area of social psychology. The concept of moral stages was described by James Mark Baldwin (1897) in his work concerning mental development (pp. 44-51). Baldwin maintained that a person, through imitation, moves from a private habitual self to an accommodating self-stage. With the impact of family law, the child then progresses to the stage of a self that fulfills law. A new thought of self emerges along with the conception of law. Concerning this stage, Baldwin (1897) suggested, "By the action he performs through obedience, he learns the meaning of these actions: how they feel, what good or evil results they lead to" (p. 47).

Lawrence Kohlberg's stage theory of moral development was based on the work of Kierkegaard, Baldwin, and Piaget's theory of cognitive and affective development since all of these theories share the stage principle. Kohlberg (1981) stated, "I orient not to psychodynamic theory but to the cognitive-development theories of moralizations: to that of Piaget (1932) and the American forerunners of Piaget – James Mark Baldwin (1897), John Dewey (1932), and George Herbert Mead (1934)" (p. 4).

While Piaget's concept of stages pertains to a child's overall development from birth through adolescence, Kohlberg's use of stages can extend into the human adult period. The term "child" is used when describing Piaget's four stages (Wadsworth, 1971/1984, pp. 26-27).

Using Baldwin and Piaget's concept of stages, Kohlberg developed a theory of moral development that addresses individual differences and remains independent of chronological age. With knowledge of the various stages, one can move from a lower to a higher stage of moral thinking. This theory provides a means for the analysis of individual moral decision-making and helps in the understanding of why people behave unethically without a sense of awareness of the actions being wrong. One problem with the theory relates to the fact that people in higher stages continue to partake in unethical behavior due to what Aristotle referred to as the irrational nature of the appetitive soul.

Additionally, Carol Gilligan's work from a feminist perspective is examined in light of Kohlberg's contribution to our understanding of the complex nature of human moral development.

Kohlberg's theory of moral development

Kohlberg's stage theory of moral development consists of six stages (1-6) that are spread across three general levels: (A) preconventional, (B) conventional, and (C) postconventional (Kohlberg, 1981, pp. 17-19). While the use of stages had been utilized by others in modeling moral development, Kohlberg established a set of stages that were described in a more precise manner than his predecessors had done.

Concerning the preconventional level, Kohlberg (1981) stated, "At this level, the child is responsive to cultural rules and labels of good and bad, right and wrong, but

interprets these labels in terms of either the physical or the hedonistic consequences of action…" (p. 17). The first level contains stage one, "The punishment and obedience orientation" and stage two, "The instrumental relativist orientation" (p. 17).

Level A: preconventional - stage 1: the punishment and obedience orientation

Kohlberg (1981) described the first stage as: "The physical consequences of action determine its goodness or badness regardless of the human meaning or value of these consequences. Avoidance of punishment and unquestioning deference to power are valued in their own right" (p. 17).

In this stage, reinforcement and the power of authorities provide the solid means of motivation in contrast to any underlying moral obligations. Concerning the first stage, Kohlberg (1981) remarked, "This stage takes an egocentric point of view. A person at this stage doesn't consider the interests of others… Actions are judged in terms of physical consequences rather than in terms of psychological interests of others" (p. 409). Within the first stage, a person's moral perspective is purely reactive and operates within the constraints of authority and history of reinforcement.

Stage 2: the instrumental relativist orientation

The last stage in the preconventional level involves fairness, reciprocity, and equal exchange within the context of a physical and pragmatic environment. Kohlberg defined this second stage as:

> Right action consists of that which instrumentally satisfies one's needs and occasionally the needs of others. Human relations are viewed in terms like those of the marketplace. Elements of fairness, reciprocity, and equal sharing are present, but they are always interpreted in a physical,

> pragmatic way. Reciprocity is a matter of "You scratch my back and I'll scratch yours. (Kohlberg, 1981, p.17)

This stage recognizes the needs of others merely as a means to meet one's own interest through agreements and deals. Much of our corporate environments operate at this low level. The selfish nature of this first level is evident in this stage because any good provided to others is done with the expectation of receiving an equal quality of goodness in return.

There remains no concept of character or moral virtue within the framework of the first level. Good actions are done in accordance to hedonistic, behaviorist, and egocentric principles. A truly self-interest perspective provides the overriding characteristic of both stages in the instrumental relativist level.

Conventional level

In the second level, the expectations of family, group, or nation becomes valuable in its own right and loyalty emerges as a precept to morality. Stages three and four of Kohlberg's theory of moral development are found within the scope of the conventional level. The social characteristics of humanity become more significant during both stages of the second level.

Stage 3: the interpersonal concordance or "good boy – nice girl" orientation

Stage three revolves around one's immediate social group and was described as:

> Good behavior is that which pleases or helps others and is approved by them. There is much conformity to stereotypical images of what is majority or "natural" behavior. Behavior is frequently judged by intention – the judgment "he means well"

> becomes important for the first time. One earns approval by being "nice." (Kohlberg, 1981, p. 18)

The individual begins to see the importance of living in a social group during this stage and the moral focus begins to extend beyond one's self to others at a higher level than in the previous stages. The focus on "intention" is an important factor since the character of an individual begins to emerge as a criterion of moral judgment in contrast to a reliance on consequences. The conformity to stereotypical images and the approval of others illustrate that reinforcement continues to be a factor in the individual's overall moral makeup.

Stage 4: society maintaining orientation

Stage four enlarges the moral landscape from an individual's close-knit group to society in general with a greater emphasis on duty and obligations to society. Kohlberg (1981) described stage four as: "There is an orientation toward authority, fixed rules, and the maintenance of the social order. Right behavior consists of doing one's duty, showing respect for authority, and maintaining the given social order for its own sake" (p. 18).

During this stage, the meaning and importance of social interaction becomes evident largely to encompass the importance of society. The "whole" of society is seen as being good in itself. Concerning the social perspective of this stage, Kohlberg mentioned:

> This stage differentiates social point of view from interpersonal agreement or motives. A person at this stage takes the viewpoint of the system, which defines roles and rules. He or she considers

> individual relations in terms of place in the system. (Kohlberg, 1981, p. 411)

The utilitarian influence is seen throughout the preconventional and conventional levels. While there are hints of character-based ethics, external influences primarily determine moral decisions. Regardless of the utilitarian orientation, the growing sense of duty and the desire to maintain social order for its own sake represents a major departure from the selfish motives of the earlier stages.

Postconventional, autonomous, or principled level

An effort is made at this third level to define moral values and principles that are valid and separate from the authoritarian influences. The last two stages of moral development are found in this highest level. Stage five is very much like John Stuart Mill conception of utilitarianism. The highest level pertains to the identification of *a priori* and universal normative standards. This level tends to be characteristic of Kant's categorical imperative notion of ethics. Kohlberg's final stage fails to support a full virtue ethics theory such as was grounded in Aristotle and reminiscent of Christian virtue ethics.

Stage 5: the social contract orientation

In the development of the fifth stage, Kohlberg emphasized the importance of utility and critically examined standards:

> Right action tends to be defined in terms of general individual rights and in terms of standards that have been critically examined and agreed on by the whole society. There is a clear awareness of the relativism of personal values and opinions and a corresponding emphasis on procedural rules for

> reaching consensus. Aside from what is constitutionally and democratically agreed on, the right is a matter of personal "values" and "opinion." The result is an emphasis on the "legal point of view," but with an emphasis on the possibility of changing law in terms of rational considerations of social utility (rather than freezing it in terms of Stage 4 "law under order"). Outside the legal realm, free agreement and contract are the binding elements of obligation. This is the "official" morality of the American government and Constitution. (Kohlberg, 1981, pp. 18-19)

This stage provides a set of normative ethical standards based on a utilitarian belief structure and is dependent on society's determination of what is morally acceptable. This utilitarian basis does not provide any concrete principles of right and wrong that withstand the winds of time and place.

It is important to understand that these six stages of moral development do not correlate with an individual's age. Kohlberg noted that many adults operate at lower stages and few reach the summit as represented in stages five and six.

Stage 6: the universal ethical principle orientation

According to Kohlberg, the highest level of moral development occurs at stage six where universal ethical principles form the basis for moral decision-making. Kohlberg described the highest stage in the theory as:

> Right is defined by the decision of conscience in accord with self-chosen ethical principles appealing to logical comprehensiveness, universality, and consistency. These principles are abstract and ethical (the Golden Rule, the categorical imperative); they are not

> concrete moral rules such as the Ten Commandments. At heart, these are universal principles of justice, of the reciprocity and equality of human rights, and of respect for the dignity of human beings as individuals. (Kohlberg, 1981, p. 19)

Kohlberg falls short in his theory since he did not address the issue of individual virtues. He relied more on general universal concepts that are self-chosen. The self-chosen aspect is what stands stage six apart from stage five. The focus shifts from the society in general to one's inner character. Stage six is very much in the Kantian tradition especially with the reference to "logical comprehensiveness" and the abstract nature of the normative ethical rules that are utilized. Being abstract, these normative rules fail to produce an unchanging universal platform for effective moral decision-making. Kohlberg does not base morality on a solid theory of virtue ethics. In contrast, the use of, "self-chosen ethical principle" takes one back to the early stages where utilitarianism dominated the ethical groundwork.

Additionally, the Kohlberg theory is flawed due to his attempt to project an ethical framework to the entire human population when his research was based solely on a male sample. The emergence of human morality is complex and there are many more variables found within the social web of human experiences that make it difficult to apply the stage theory in a general way. While providing a useful framework, the substance of the stage theory of moral development is based on insights from Piaget's existing theory and observations of human social interactions and experiences. Research in the area of Cognitive development may provide a more comprehensive set of answers to the multi-dimensional problems associated with human moral development. Many of the answers

will become less opaque as research continues in the area of cognitive development. A greater level of truth will emerge from interdisciplinary research. The primary variables that interact with human moral development will need to be identified and various relationships established.

Gilligan's contribution to the stage theory of moral development

Carol Gilligan's work came in response to male dominated research in the area of moral development. Gilligan saw the moral development of women in a "different voice" and proposed a distinct theory to account for various gender differences overlooked by other researchers.

In the *Moral Judgment of the Child,* Piaget (1962) primarily focused on the moral development of boys with little reference to girls. In describing a different model for female moral development, Gilligan (1982/1993) noted that the "child" in Piaget's work was assumed male. Concerning Kohlberg's research, Gilligan (1982/1993) said, "in the research from which Kohlberg derives his theory, females simply do not exist" (p. 18).

Concerning the observation that women appear to be deficient when measured by Kohlberg's scale, Gilligan (1982/1993) remarked: "Yet herein lies a paradox, for the very traits that traditionally have defined the goodness of women, their care for and sensitivity to the needs of others, are those that mark them as deficient in moral development" (p. 18).

The "different voice" started to emerge with the following from Gilligan's research:

> When one begins with the study of women and derives developmental constructs from their lives, the outline of a moral

> conception different from that described by Freud, Piaget, or Kohlberg begins to emerge and informs a different description of development. (Gilligan, 1982/1993, p. 19)

In describing this different voice, Gilligan (1982/1993) noted, "the activity of care centers moral development around the understanding of responsibility and relationships…" (p. 19). Gilligan saw this gender difference as the primary reason for the shortfall of Kohlberg's system. Care and responsibility stand out as the key elements of Gilligan's theory. Blum (1988) stated, "that care and responsibility within personal relationships constitute an important element of morality itself, genuinely distinct from impartiality" (p. 473). Additionally, Blum (1988) suggested that Gilligan's views a thick moral self deeply rooted in historical connections and relationships.

In contrast to Kohlberg's view, Gilligan's notions suggested an, "understanding of relationships informed by care, love, empathy, compassion, and emotional sensitivity" (Blum, 1988, p. 475). The above attributes form the basis of Gilligan's "different voice" approach to moral development in women. Blum (1988) continued with the suggestion that emotions were not a significant factor in Kohlberg's theory, but for Gilligan, "morality necessarily involves an intertwining of emotion, cognition, and action, not readily separable" (p. 476).

A computer science study noted distinctly differences in how men and women view ethics with the conclusion:

> Men and women were distinctly different in their assessment of what is ethical and unethical behavior. For all scenarios, men were less likely to consider a behavior as unethical. Moreover, their

> judgment was most often influenced by their personal values and one environmental cue – whether the action was legal. Women were more conservative in their judgments and considered more environmental cues, as well as their own personal values. (Kreie & Cronan, 1998, p. 76)

This set of results supports Gilligan's notion that women have a different voice concerning moral decision-making. Additionally, the results of this study by Kreie and Cronan (1998) are in contrast to the observation that placed women at lower stages of moral development when measured with the Kohlberg methodology.

Another paper used cyber stalking to illustrate how feminist ethics can be effectively brought into the area of computer ethics (Adam, 2001). Concerning cyber stalking, Adam (2001) suggested, "An argument from feminist ethics and related theory could, at least, help us to understand why the behavior takes place in the first place and can begin to suggest policy measures to tackle the problem" (p. 254). Recent literature in computer ethics has acknowledged Gilligan and has recognized feminist ethics in dealing with the moral issues surrounding the modern computer.

The criticism labeled against Kohlberg concerning his population and sample selections can be applied to Gilligan's research. In developing the notions associated with the "different voice," Gilligan utilized a female only population. While this work provides a distinction between moral thinking of males and females, a synthesis is needed to combine the Kohlberg and Gilligan theories with other ideas to formulate a comprehensive model for human moral development.

Concluding remarks

The moral stage theory concept is important in the descriptive area of understanding the hierarchical nature of moral development. The major problem with the stage theory of moral development has to do with the descriptive concept of stages being used in a prescriptive manner. One could say, "Since you are just in state N, it is acceptable to behave as you are." Another problem pertains to the issue of one being at a "high" stage and still behaving in an unethical manner due to aspects of our human nature. As a descriptive tool, the notion of moral stages can assist with the understanding of moral development processes. It is important to understand that while one may be at a higher level, the individual's actions may correspond with a lower level.

An awareness of the Kohlberg and Gilligan theories is important for computer science education. One must understand the ethical perspectives of both male and female students for effective presentations regarding computer ethics to be delivered. Kohlberg's theory helps resolve such different ethical issues as treating virtual property at the same level as physical property. While students may respect tangible property rights, they may not be at that ethical stage involving intangible property. The stage concept illustrates different levels of moral thinking among students. A synthesis of Kohlberg and Gilligan helps not only in the establishment of an ethical base-line for the determinations of where students are in their ethical thinking, but for the effective development of computer ethics instruction.

Our male computer science students need to become more aware of the ethical sensitivities of female information technology students. Additionally, female computer science students need to understand the ethical viewpoints of male students in their discipline. The predominant male population in computer science classrooms will

encounter female information technology professionals in industry. With a greater level of instructor understanding of Kohlberg and Gilligan' work, our future computer science graduates will have a greater impact on the computer profession in the years to come.

The Kohlberg theory is useful in providing a framework for understanding moral development in an idea sense but suffers under the complex nature of human moral decision-making. Gilligan's contribution sparked an important debate and continued research concerning the importance of gender differences in ethics and especially in computer ethics where additional knowledge is vital with regard to such issues as compassion and the overall adherence to sound ethical principles.

Appendix K

Concluding Remarks Concerning Ethical Theories

These ethical theories illustrate the importance that human kind has placed on moral philosophy. From such notions as natural justice, natural law, and the Christian worldview emerges a set of ethical principles that remain constant throughout space and time. These principles of right and wrong must be viewed within the context of specific situations. Outside the scope of particular human experiences, these principles are universally accepted as either right or wrong.

In particular cases, wrong actions are justified when used to counteract larger evils. When such actions are selected because of a lesser of two evils situation, the human being has knowledge of the unethical characterizes of the action but understands the overall consequences of what is being done. The natural law ethical framework provides an effective method for handling the complex nature of technology-related moral decision- making.

The universal nature of the natural law ethical framework places our foundation of moral decision-making on the same plane as the scientific laws of nature that have remained constant for centuries. When placed on such a firm foundation as natural law, moral laws also remain constant as the human experience advances through the phenomena of time where centuries represent mere ticks on the eternal clock of nature.

Appendix L

The Distinction between Morals and Ethics

The first item to address relates to the distinction between morals and ethics. While these terms are used interchangeably in the computer ethics literature, a comprehensive understanding of the semantics associated with these terms is needed for the development of computer ethics. The following analysis illustrates the discrepancy among selected morality/ethics related definitions.

In an analysis of the nature of being morally considerable Goodpaster (1978) suggested that we can define morality as having both an object and having the object of mitigating suffering. The mention of "suffering" brings out the notion of "harm" that represents one of the underlying themes in Ethics.

A dictionary of philosophy defined ethics as an inquiry into the nature of morality or moral acts (Angeles, 1981). In a classic edition of *The Counseling Psychologist*, Kitchener (1984b) stated, "we could say that morality referred to the human belief structure, ethics was the philosophic study and evaluation of that belief structure" (p. 16). Kitchener introduced five ethical principles in her 1984 paper concerning the field of counseling psychology. The principles were identified as autonomy, nonmaleficence, beneficence, justice, and fidelity. Kitchener saw autonomy as relating to a person's responsibility for their own behavior, freedom of choices, and decision-making (Kitchener, 1984a, p. 46). The principle of nonmaleficence was said to be most easily understood as "above all do no harm" (Kitchener, 1984a, p. 47). Kitchener (1984a) described beneficence as simply "doing good for others" (p. 49). In the tradition of Aristotle, Kitchener (1984a) maintained that justice suggests, "Equal persons have the

right to be treated equally" (p. 49). Fidelity, the last of Kitchener's five moral principles, involves aspects of "faithfulness" including promise keeping and loyalty (p. 51).

In a discussion of the (then) new ACM code of ethics, Anderson, Johnson, Gotterbarn, and Perrolle (1993) talked about what was referred to as "General Moral Imperatives", including concepts associated with the contribution to society, harm, honesty, discrimination, honoring property rights, intellectual property, privacy, and honoring confidentiality. These moral imperatives were said to relate to the professional adherence to the association's code of ethics. All of these concepts have a direct relationship to the ethical administration of modern database technology.

Hancey and Kingsbury (1994) cited another source, "Moral is used to describe conformity with generally accepted standards of goodness or rightness in conduct or character, while ethical is used to describe conformity with a code of moral principles" (p. 3). In another paper the following distinction between morals and ethics was provided as "Morals as individual beliefs of right and wrong; whereas ethics are the right and wrong standards generally accepted by society" (Hanchey & Kingsbury, 1994, p. 3). This definition places ethics as the foundation for moral behavior.

Rogerson (1995) stated, "Ethics is value driven, action oriented and determined by the situation. In other words, ethics ensures that an action that is designed to achieve a certain objective will do so without violating a value. The only thing that is ever judged to be ethical or unethical is an action" (p. 2).

(Werth, 1997, p. 2) provided a table with the following precise definition of morality and ethics:

Morality -- Those standards of conduct everyone wants everyone else to follow even if their following them would mean they had to do the same

Ethics -- Those morally permissible standards of conduct every member of a group wants all other members to follow even if their following them would mean that he or she had to do the same

In this paper, the definitions of morality and ethics sounded very similar with little distinction between the two terms. Additionally, the definitions were worded in a very "utilitarian" manner.

In a paper regarding a comparison of attitudes of first year undergraduates, MIS majors, and practitioners, Summer and Werner (1997) mentioned that morality is unique to each person and developed over time through cultural, social, and political exposure. Additionally, Summer and Werner (1997) stated that, "Each individual has a set of norms, beliefs, and values that together form his or her moral perspective. And that "Ethical analysis sometimes relies upon comparing the costs and benefits of an action" (p. 2).

In one paper concerning the moral and ethical problems of information technology, the following attempt to deal with the misuse of terminology with respect to the terms ethics and morals was presented:

Hacking (in a general sense) is not an ethical problem. We recognize ethical problems as those with a demonstrably wrong outcome or those, which are inherently unfair. Hacking is a serious problem because it is morally wrong to gain

unauthorized access, but is not an ethical problem however, we still seek to avoid this course of action. (Siponen & Kajava, 1997, p. 3)

Carlisle mentioned that T. M. Jones had stated that an immoral act is either illegal or morally unacceptable to the larger community without any reference to the term, "ethics" (Carlisle, 1999, p. 353). This is another example of the utilitarian influence in our modern ethical thinking. In 1954, Weiner provided three key ethical principles: freedom, equality, and benevolence (Bynum, 2000). A professional psychologist once told me that ethics is "Any action or speech done with care not to hurt any other individual" (Tujague, 2002). The "with care" aspect of the following definition implies that one must think about their actions within the guidelines that make up their character.

The distinction between morals and ethics was provided in a very particular manner in the materials for a Wilfrid Laurier University Computer Ethics course (McNulty, 2003). Morality was described as a general system of social rules and requirements while ethics represented either a specific system of rules or the study of morality (McNulty, 2003). Ethics can be seen as "pure" while morals can be thought of as being based on ethics and influenced by variables within each particular situation. The use of, "general system" could be seen as a set of universal values that are unchangeable and not affected by place and time.

Many of the definitions of morals and ethics have a utilitarian flavor since they rely on the consequences of behavior and social acceptance. A more firm foundation is needed that provides stability and is universal. One approach is to build computer ethics from a Christian corner stone, where morality is grounded in natural law. The moral laws that reside within the scope of natural law are synonymous with the laws of science in

that the validity of these universal principles is not affected by their time and place in the universe. With this foundation, ethical decisions are based on natural law in contrast to the social approval of future consequences.

With the Internet, the future consequences may not be clear due to factors associated with the technology. With the utilitarian approach, the semantics associated with the terms morals and ethics lack consistency and provide a poor foundation for computer ethics. In the book, *Habits of the High-Tech Heart*, Shultze (2002) defined ethics as "the realm of moral obligations and standards of right conduct" (p. 29). The use of the word "standards" implies a universal foundation for the analysis of actions. A publication in the area of data mining described ethics as:

> Ethics will be referred to as a set of moral principles or a system of values which guides the behaviour of individuals and organizations. It is the *correct* way of doing things which as judged by society and often enforced through law (such as anti-discrimination legislation). To act ethically involves acting for the benefit of the community. It is entirely possible to act unethically yet legally. (Fule & Roddick, 2004, p. 159)

The Latin root of the word moral (moralis) suggests customs and individual actions. In contrast, the Greeks viewed ethics (ethos) as a set of standards that are more lasting and span across the boundaries of human generations. The current level of confusion between these two terms is primarily a result of the influence of utilitarianism with its lack of concrete standards. It seems more appropriate to use the term "morals" in conjunction with utilitarianism and "ethics" within a character-based ethical framework since ethics represents stability.

In summary, ethics provides human kind with the standards of right and wrong based on an ideal code of moral principles. The term "moral" has to do with the use of our ethical standards in the analysis of actions that form the basis of our human experience. Morals help us form a distinction between right and wrong conduct. Morals are involved with the determination of which principles of ethics are applicable in choosing an appropriate choice of action.

Appendix M

Ten Commandments of Computer Ethics

1. THOU SHALT NOT USE A COMPUTER TO HARM OTHER PEOPLE.

2. THOU SHALT NOT INTERFERE WITH OTHER PEOPLE'S COMPUTER WORK.

3. THOU SHALT NOT SNOOP AROUND IN OTHER PEOPLE'S COMPUTER FILES.

4. THOU SHALT NOT USE A COMPUTER TO STEAL.

5. THOU SHALT NOT USE A COMPUTER TO BEAR FALSE WITNESS.

6. THOU SHALT NOT COPY OR USE PROPRIETARY SOFTWARE FOR WHICH YOU HAVE NOT PAID.

7. THOU SHALT NOT USE OTHER PEOPLE'S COMPUTER RESOURCES WITHOUT AUTHORIZATION OR PROPER COMPENSATION.

8. THOU SHALT NOT APPROPRIATE OTHER PEOPLE'S INTELLECTUAL OUTPUT.
9. THOU SHALT THINK ABOUT THE SOCIAL CONSEQUENCES OF THE PROGRAM YOU ARE WRITING OR THE SYSTEM YOU ARE DESIGNING.

10. THOU SHALT ALWAYS USE A COMPUTER IN WAYS THAT INSURE CONSIDERATION AND RESPECT FOR YOUR FELLOW HUMANS.

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http://www.brook.edu/dybdocroot/its/cei/overview/Ten_Commanments_of_Computer_Ethics.htm