Professional Ethics in Software Engineering Curricula

Gordana Dodig-Crnkovic
Mälardalen University
Department of Computer Science and Electronics
Box 883, 721 23 Västerås, Sweden
gordana.dodig-crnkovic@mdh.se

Ivica Crnkovic
Mälardalen University
Mälardalen Real-time Research Centre
Box 883, 721 23 Västerås, Sweden
ivica.crnkovic@mdh.se

ABSTRACT

Engineering has a direct and vital impact on the quality of life of people. The services provided by engineers are required to take into consideration the safety, health and welfare of the public. Engineering Ethics is of relevance to the majority of people within the field of computing which has its own particular ethical concerns. Computer Ethics (with Software Engineering Ethics as its subfield) has thus been developed as a specific branch of Applied Ethics. It is important to recognize that prudent ethical judgment is an essential requirement of computer professionals. The aim of this paper is to shed light upon the significance of teaching ethical issues in Software Engineering curricula. It argues that education in Ethics should be incorporated in computing curricula. Experience from the course "Professional Ethics in Science and Engineering" given at Mälardalen University in Sweden is presented as an illustration.

Categories and Subject Descriptors

D.2 SOFTWARE ENGINEERING

General Terms

Human Factors, Theory, Legal Aspects.

Keywords

Software Engineering, Education, Professionalism, Ethics.

1. INTRODUCTION

Computers play an essential role in today's industry, commerce, government, research, education, medicine, communication systems, entertainment, and in many other areas of our society. Professionals who contribute to the design, development, analysis, specification, certification, maintenance and evaluation of the many different applications of computer systems have a significant impact on society, making valuable contributions to the community, but also, possibly, some less positive.

To ensure that their efforts will be used for the general good, computing professionals must commit themselves to making Computing a beneficial and respected profession, promoting an ethical approach to their professional practice.

Computing Curricula 2001, The Joint Task Force on Computing Curricula of IEEE Computer Society and Association for Computing Machinery (ACM), emphasizes strongly professional issues, making them part of a core curriculum for computing, see [14].

The Engineering Criteria of the Accreditation Board for Engineering and Technology (ABET) [15] affirm that "Engineering programs must demonstrate that their graduates have an understanding of professional and ethical responsibility." The Board strongly encourages engineering schools to provide students with tools for making ethically prudent decisions: "Engineering programs must demonstrate that their graduates have the broad education necessary to understand the impact of engineering solutions in a *global* and *societal context*." This criterion highlights the importance of both micro-ethics (right choices made by individuals), and macro-ethics (right choices made by groups, societies and organizations). Furthermore, [15] "… a major design experience…that includes most of the following considerations: economic, environmental, sustainability, manufacturability, *ethical*, health and safety, *social*, and political." [Italics added] This clearly shows the need to develop the ability of students to make appropriate ethical decisions.

Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering [13] indicate the importance of an "understanding and appreciation of professional issues related to ethics and professional conduct, economics, and societal needs". Further, professionalism and ethics are recommended as parts of a subject "Professional Software Engineering Practice" from which students will gain the ability to make proper decisions based on ethical codes and ethical principles, to develop concern for safety and security requirements, human and personal rights, to understand and follow the relevant laws and standards, and to be able to understand the effects of engineering decisions on the community, environment and individuals.

In spite of the above clear policy statements, professionalism and ethics are seldom present in Software Engineering undergraduate and graduate curricula. For example, in Sweden, only certain colleges and universities offer their students an opportunity to study professional ethics. Examples are The Royal Institute of Technology which gives courses in Engineering Ethics and Mälardalen University at which there is a course in Professional Ethics in Science and Engineering, presented for the first time in 2003. Beginning in September 2005, the Swedish Linköping University, the Norwegian University of Science and Technology NTNU, and Utrecht University jointly offer an Erasmus Mundus Master's programme in Applied Ethics (MAE), the courses which it offers including Computing Ethics.

During the educational and training session at ICSE 2005 [25], questions about whether education and training in Ethics in Software Engineering curricula is necessary, or whether this undoubtedly important issue can be learned in some other ways – in secondary schools, at home, via public information etc. were the subject of an interesting discussion.

The aim of this paper is to show that more than that kind of general knowledge of professionalism and ethics is required for the successful performance of a software engineer. There are many ethical concerns which are specific to Software Engineering and Computer Science. The following are examples [1]:

- Social context of computing
- Methods and tools of analysis of ethical argument
- Professional and ethical responsibilities
- Risks and liabilities of safety-critical systems
- Intellectual property
- Privacy and civil liberties
- Social implications of the Internet
- Computer crime
- Philosophical foundations of ethics

Furthermore, our aim is to demonstrate that many important engineering decisions are based on both engineering and ethical principles. We argue that training and education in professionalism and ethics should be an obligatory part of a Software Engineering curriculum. Following this assumption we have developed a course "Professional Ethics in Science and Engineering" now included in the Computer Science and Software Engineering Curriculum at Mälardalen University (MdH). We give a short overview of this course, our experience and that of our students, and we present some direct consequences in an industrial context evident through the work of our industrial PhD students.

The rest of the paper is organized as follows. Section 2 discusses engineering, its impact and possible (unwanted) consequences of engineering decisions. Section 3 gives an introduction to Professional and Computer Ethics, the basic principles of Ethics and the specifics of Computer Ethics. Section 4 argues why Ethics should be taught to students of Software Engineering. Section 5 presents the course developed at Mälardalen University with the experiences of both the teachers and students. Finally, Section 6 summarizes our conclusions.

2. ENGINEERING AS SOCIAL EXPERIMENTATION

"All products of technology present some potential dangers, and thus engineering is an inherently risky activity. In order to underscore this fact and help in exploring its ethical implications, we suggest that engineering should be viewed as an experimental process. It is not, of course, an experiment conducted solely in a laboratory under controlled conditions. Rather, it is an experiment on a social scale involving human subjects." [4]

Why can we view engineering projects as social experiments?

There are uncertainties in every design process which are the result of our limited (finite) resources. Thus pharmaceuticals are tested in a limited (but of course representative) context. Construction materials are tested under certain conditions. Computer programs are tested for a large but finite number of cases. This implies that an engineered product may, sooner or later in its application, be used under conditions for which it has never been tested. New uncontrolled, unpredicted circumstances can appear. We expect the product to function properly, or at least safely, even in such circumstances. It is an engineer's responsibility to foresee and prevent as far as possible any severe consequences of product/system malfunction.

The *Titanic*, for example, was considered to be virtually unsinkable. The worst accident scenario considered was a collision at the junction of two of its sixteen watertight compartments and it was therefore designed to remain afloat with any four compartments flooded. What actually happened was that the collision with the iceberg caused a large rip in the side of the ship flooding *five* compartments!

Modern history provides a wealth of other examples of engineering failures with severe consequences. The intense media coverage of disasters such as the explosion of the Ariane V rocket in 1996, because of the incorrect reuse of some of the software developed for the Ariane IV and the radiation overdoses in the Therac-25 computerized linear accelerator for cancer treatment has increased the interest in engineering ethics. Major technical disasters are extremely costly but fortunately happen rarely. The judgment made by an engineer about what "rest risk" in a safety analysis is acceptable is, to a high degree, an *ethical* one.

3. WHAT IS COMPUTER ETHICS?

"There are few things wholly evil or wholly good. Almost everything...is an inseparable compound of the two, so that our best judgment of the preponderance between them is continually demanded." Abraham Lincoln

Computer Ethics might be defined as 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. (Moor, 1985)

Ethical problems arise most often when there are differences of judgment or expectations about what constitutes the true state of affairs or a proper course of action. The engineer may be faced with contrary opinions from within the firm, from the client, from other firms within the industry, or from government. An individual makes ethical decisions, in his/her capacity as a member of different groups. In order to make ethical decisions, an engineer interacts in many directions and within many different contexts, each of which can show the actual situation in a different light. For example, solving the problem of the relation individual – colleagues – management could lead to certain choices, which e.g. do not necessarily coincide with the views of his/her own family or friends, or the clients, authorities, societies or other industries.

When faced with a moral/ethical dilemma, a professional must be able to make rational and well-motivated decisions. Courses in Ethics can help professionals by offering tools and methods useful in such situations.

3.1 Uniqueness Debate in Computer Ethics

The basic principles of ethics are constant, no matter in which area they might be applied. The principles of Medical Ethics, Legal Ethics, and Computer Ethics are basically the same. However, only the first two of these are generally acknowledged as branches of Applied Ethics. In much the same

way as for other Applied Ethics fields, new circumstances related to the computer do raise new questions about *how* general principles are to be applied, which results in *policy vacuums* designated thus by Moor [10] and further discussed in [1][12][6].

A general comment can be made regarding the uniqueness debate. Two things that are similar are always *similar in certain respects*. Uniqueness, as well as similarity is always *relative*.

Uniqueness is a matter of focus and context. Looking at the set of all possible ethical problems, different patterns can be recognized permitting their grouping into Medical Ethics, Political Ethics, Environmental Ethics, and Business Ethics etc. There are several criteria for grouping problems within certain fields. One is the *importance (urgency)* of the ethical problem. The other is its specific and unique character. As an example we can mention Bioethics, a field of Applied Ethics, rapidly emerging, principally because of the urgency of problems of genetic manipulations of living organisms. Tavani [12] concludes his article on the uniqueness debate stating that the Computer Ethics issues are both philosophically interesting and so important that they are deserving of our attention, no matter whether or not those issues are "unique" ethical issues.

In what follows we will argue that the social importance of the computer as a revolutionary machine together with its specific features give rise to new ethical problems and demands the introduction of the field of Computer Ethics. Some of the characteristic problems particular to computing technology are listed in the following.

Logical malleability. Computers are malleable in a logical sense in that the results they produce can be shaped and molded to simulate any activity that can be characterized in terms of inputs, outputs, and associated logical operations [10]. Computers are thus used as tools for representation, modeling and simulation and they thereby have become a materialization of our conceptual knowledge of the world. For our epoch, they are The Revolutionary Machine in the same sense as the steam engine was for the industrial era. The ethical consequences of the fact that the computer is an artifact defining our contemporary culture are many. Computing has become a complex and growing part of society – with profound and broad social implications. A specific technical expertise is necessary to be able to understand the problems within the field.

One can ask the following question in order to elucidate the uniqueness issue: Why not car ethics? Even though the automobile is almost as ubiquitous as a computer, the ethical questions (safety and environmental impact) related to cars are conceptually relatively simple and already taken into consideration within other ethical disciplines. The complexity of ethical issues related to computers, together with their extraordinary cultural role and the fact that an understanding of the technical details of the problem involved is often necessary to be able to see its ethical implications clearly provides a foundation for Computer Ethics as a specific Applied Ethics discipline.

Speed. Speed and the simplicity of handling large amounts of data are connected with risks for unintentional transfer of incorrect data, as well as other ethical problems such as privacy and security intrusion because of unintended or uncontrolled movement of data.

Storage of huge amounts of data. When recorded and shared with other computers, information about people (accurate or inaccurate) can be used to invade personal privacy and integrity in a way never before possible in history. The ease with which data saved in a computer can be manipulated ("as if they are greased" [11]) makes the use of surveillance, monitoring and spyware methods a simple technical operation.

Identity vagueness. It is possible with a computer to steal another person's identity, forge a message, or send a message anonymously. For example, present-day vague identities make possible "spam". There is an on-going ethical debate about the pros and contras of anonymity, and under which condition anonymity can be acceptable in communication.

Copying. Images, text and sound can be copied with a computer by means of a few clicks and the copy easily used without attribution to the author or out of context. This has resulted in the ongoing discussion about intellectual property, and about the problem of ascertaining the originality of school homework and student essays.

Openness and availability. Computer networks make it easy for the user to acquire a virtually unlimited volume of diverse information. In the cases of pornography or gambling, or of sites with any kind of propaganda or superstition, these might be difficult to handle by certain groups of users. Cyberstalking is an example mentioned in Tavani [12]. Even spam and other unwanted messaging is a consequence of the openness of the system and the availability of data such as e-mail addresses.

Internationality. Computer communication does not stop at national boundaries. What is considered legal in one country might not be so in the neighbouring, or some other country.

Power mediation. Computing is so far a well-educated-younger-male-dominated field. This domination can be seen as an inequity. The computer is increasingly becoming such a basic tool that it is unacceptable for certain social groups to be denied equal access to it, especially in the e-government era. The related ethical questions include the distribution of political power, equal opportunities, equity, fairness and justice.

Privacy. Computers are very powerful tools for collecting data about people in order to determine their habits and patterns of behavior and they may be used for both legal and illegal surveillance. This can be used to enhance public security and safety, but also to invade the privacy and personal integrity of the citizen. Concern about the protection of the privacy of citizens has resulted in an intentional design for democracy, a project to incorporate privacy protection into technology design and practices. An example of the realization of intentional design for democracy is in the work of the CyLab group at Carnegie Mellon. This includes both technical and ethics research into the development of protocols and policies

that effectively balance privacy rights with Internet security. Here we can also mention Microsoft's Trustworthy Computing Initiative, [34].

3.2 Codes of Ethics and Professional Conduct

How can we work to ensure that computing technology not only respects but also advances human values? It is necessary to integrate computing technology and human values in such a way that the technology protects and advances rather than harms human values. Much of the ground work in doing this is performed with the help of codes of ethics.

Professional societies in science and engineering publish their ethical codes or guidelines. See [16][17][18][19][20][21][22][23] which present a sampling of ethical codes from societies of professional engineers and scientists. Some differ widely in their content, because of their origins and their specific purposes, but the main topics and the general ethical standards they articulate are similar.

Codes of Ethics express the consensus of the profession concerned regarding ethical issues. At the same time they are a means of informing the general public about the ethical norms and values of the profession. An essential characteristic of a profession is therefore the need for its members to conform to its Code of Ethics.

Professional codes of ethics should be understood as conventions between professionals. Having a code of ethics allows an engineer to object to pressure to produce substandard work not merely as an ordinary citizen but as a professional engineer (or doctor, or scientist, etc.) who can say "As a professional, I cannot ethically put business concerns ahead of professional ethics." [3].

Harris, Pritchard, [5] summarize Unger's analysis of the possible functions of a code of ethics:

"First, it can serve as a collective recognition by members of a profession of its *responsibilities*. Second, it can help create an environment in which *ethical behavior is the norm*. Third, it can serve as a *guide or reminder* in specific situations. Fourth, the process of *developing and modifying* a code of ethics can be valuable for a profession. Fifth, a code can serve as an *educational tool*, providing a focal point for discussion in classes and professional meetings. Finally, a code can *indicate to others* that the profession is seriously concerned with responsible, professional conduct."

It is important to notice that codes must be interpreted and used properly in practice:

"Codes of ethics are created in response to actual or anticipated ethical conflicts. Considered in a vacuum, many codes of ethics would be difficult to comprehend or interpret. It is only in the context of real life and real ethical ambiguity that the codes take on any meaning".

Codes of ethics and case studies are always closely related. Without guiding principles, case studies are difficult to evaluate and analyze; without context, codes of ethics are incomprehensible. The best way to use these codes is to apply them in a variety of situations and study the results. It is from the back and forth evaluation of the codes and relevant cases that well-reasoned moral judgments can be arrived at. [22].

4. WHY STUDY PROFESSIONAL ETHICS?

"Would you tell me, please, which way I ought to go from here?"
"That's depends a good deal on where you want to get to."...
(Alice in Wonderland, Chapter VI, L Carroll, 1865)

What is the point in studying engineering ethics? What can be gained from taking an Ethics course?

A Professional Ethics course is not about preaching virtue to encourage immoral and amoral students to adopt a certain established set of beliefs and behavior. It is intended, rather, to increase the ability of concerned engineers, managers and citizens, to first recognize and then responsibly confront moral issues raised by technological activity. The goal is to foster moral autonomy, i.e. the skill and habit of engineers to think rationally about ethical issues in their professional activity, and to increase their ability to think critically about moral matters. For the role of Computer Ethics in the Computer Science Curriculum, see Bynum [2], and Moor [10].

So: why learn Ethics? Here are some of the reasons given:

- To deal with the true nature of computing as a service to other human beings.[4]
- To convey a sense of professional responsibility not covered in other courses
- To sensitize students to Computer Ethics issues
- To provide tools and methods for analyzing cases
- To provide practice in applying the tools and methods to actual or realistic cases
- To develop in the student good judgment and helpful intuitions - ethical autonomy.

These topics are not addressed outside the computing curricula/Software Engineering education. As pointed out previously, a discussion of ethical questions in general is not sufficient to enable a computing engineer to identify and address the concrete ethical questions within his/her specific field of engineering.

5. COURSE IN PROFESSIONAL ETHICS FOR SCIENCE AND ENGINEERING STUDENTS AT MDH

5.1 Course Overview

Following the lines of reasoning presented in this article, we have developed a course in Professional Ethics at Mälardalen University, intended in the first place for Computer Science and Software Engineering students [24]. The emphasis is on cultivating sensibility to ethical problems, the development of moral autonomy, ethical pluralism and critical thinking.

The course gives an insight into the ethical problems important for professionals in Engineering and Science. It forms a framework in which professional and ethical issues can be analyzed, and builds up an awareness of various views of ethical issues and the ethical responsibilities of professionals.

The topics include, among others, the social context of a profession, conflicts between loyalties to different principles such as safety and economy, precautionary principle and

environmental impact, integrity, privacy, ownership, etc. Fundamental moral theories are presented in the introductory part of the course.

We discuss Codes of Ethics (such as IEEE/ACM Software Engineering Code of Ethics and Professional Practice, [18], [19], [27], Responsible Conduct of Research [26]), and examine a series of case studies which have led to ethical dilemmas. At the same time we develop critical thinking and argumentation techniques.

The course is delivered as a combination of lectures, guest lectures, classroom training (discussions), and training in writing essays. For Professional Ethics in Science and Engineering Course Syllabus 2003, see [24]. Table 1 gives an overview of the course.

Table 1 Professional Ethics Course Syllabus

Professional Ethics in Science and Engineering	
Lecture 1	Getting Started. Course Preliminaries. Identifying Moral Issues
Lecture 2	METHODS AND TOOLS OF ANALYSIS OF ETHICAL ARGUMENTS Philosophical Foundations of Ethics Ethical Relativism, Absolutism and Pluralism
Lecture 3	The Ethics of Conscience. Ethical Egoism. The Ethics of Duty. The Ethics of Respect
Lecture 4	The Ethics of Consequences: Utilitarianism The Ethics of Rights. The Ethics of Justice
Lecture 5	The Ethics of Character. Ethics and Gender
Lecture 6	SAFETY, SECURITY - Guest lecture
Lecture 7	PRIVACY AND CIVIL LIBERTIES In-class activity: CASE STUDIES
Lecture 8	ENVIRONMENTAL ETHICS In-class activity: CASE STUDIES
Lecture 9	SOCIAL CONTEXT OF THE PROFESSION - Guest lecture
Work-shop 1	PROFESSIONAL AND ETHICAL RESPONSIBILITIES: CODES OF ETHICS In-class activity: CASE STUDIES
Lecture 10	RISKS IN ENGINEERING AND SCIENCE Risks and liabilities of safety-critical systems PRECAUTIONARY PRINCIPLE
Lecture 11	INDUSTRIAL EXPERIENCES- Guest lecture
Work-shop 2	INTELLECTUAL PROPERTY. Internet. Computer Crime. In-class activity: CASE STUDIES
Work-shop 3	In-class activity: ORAL PRESENTATIONS
Work-shop 4	COURSE WRAP-UP

5.2 Professional Ethics Course Experience

Our two years experiences (2003, 2004) of the course have been very positive. Students have participated actively in discussions, case studies and research on chosen topics. Even predominantly technically-minded students were able to assimilate and use philosophical concepts presented in the introductory theoretical part of the course. The examination forms for the course were the writing of a research paper on an ethical topic of interest and an oral presentation of a chosen topic (such as safety and security, intellectual property, environmental ethics, privacy etc.) followed by an in-class discussion led by the students responsible for the actual presentation. Course evaluation results are given at http://www.idt.mdh.se/kurser/cd5590/03_11/CourseEvaluationCharts.pdf and show that students experienced the course as very useful and relevant to their future professional activities.

Moreover, two industrial PhD students have included specific chapters on ethical aspects of their work in their PhD respective Licentiate Theses as a consequence of taking part in the Ethics course [28], [29]. They have related technological issues such as product integration and component-based design to stakeholders' attitudes and decisions based on the ethical premises of the engineering in particular activities in the software development process. Three other students have published articles on their field of interest in international journals [30] and at CEPE [32] and E-CAP [33] conferences which attracted the interest of the computing and philosophy community to ethical issues related to Software Engineering.

6. CONCLUSIONS

The growing importance of computers in modern society makes the study of Computer Ethics essential both when it comes to issues related to the profession such as safety, security, privacy, environmental impact and quality and also in the everyday use of computers which gives rise to numerous ethical dilemmas.

The aim of our ethics courses in science and engineering is to increase the ability of future professionals to recognize and solve ethical problems, to accept different ethical perspectives and to adopt ethical pluralism. It develops the skill and habit of thinking rationally about ethical issues and in that way prepares students for the challenges of their profession. Experiences from the Professional Ethics in Science and Engineering Course at MdH are encouraging.

Our overall impression is that the course participants became aware of a very important component that will influence their future professional judgments and decision-making, the engineering ethical aspect. Because of our positive experience, we definitely intend to continue giving courses in ethics for engineering students in the future, convinced of their importance in the education of future engineering professionals in general, and especially software engineers, those of all computing professionals who can be expected to meet the largest variety of ethical issues. "Professional Ethics in Science and Engineering" course is now included in the Computer Science and Software Engineering Curriculum at Mälardalen University (MdH).

7. REFERENCES

[1] Barger R. N., 2001, Is Computer Ethics unique in relation to other fields of Ethics? http://www.nd.edu/~rbarger/ce-unique.html

[2] Bynum T. W., 2004, Computer Ethics in the Computer Science Curriculum. Supplementary materials for the

book Computer Ethics and Professional Responsibility, edited by Terrell Ward Bynum and Simon Rogerson.

[3] Davis, M., (1991), Thinking like an engineer: The place of a Code of Ethics in the practice of a profession", Philosophy and Public Affairs, 20.2 150-167.

[4] Gotterbarn, D. (1991). The capstone course in Computer Ethics. Proceedings of the National Conference on Computing and Values, New Haven, CT.

[5] Harris, C. E., Jr., Pritchard M. S. and Rabins M. J., 1995, .Engineering Ethics: Concepts and Cases, Wadsworth Publishing

[6] Johnson, D. G., Computer Ethics, 2003, in The Blackwell Guide to the Philosophy of Computing and Information (Blackwell Philosophy Guides), 65-75

[7] Ladd, J., 1991, The quest for a Code of Professional Ethics: an intellectual and moral confusion, Ethical Issues in Engineering, Ed. Deborah G. Johnson. Englewood Cliffs, NJ: Prentice-Hall, 130-136.

[8] Luegenbiehl, H. C., 1991, Codes of Ethics and the moral education of engineers, Business and Professional Ethics Journal 2 (1983): 41-61. Rpt. in Ethical Issues in Engineering . Ed. D. G. Johnson. Englewood Cliffs, NJ: Prentice-Hall, 137-154.

[9] Martin, M.W., Schinzinger, R., 1996, Ethics in Engineering, McGraw-Hill

[10] Moor, J, 1985, What is Computer Ethics, Metaphilosophy 16(4): 266-75. http://www.southernct.edu/organizations/rccs/resources/teaching/teaching_mono/moor/moor_definition.html

[11] Moor, J., 2004, Towards a Theory of Privacy in the Information Age. Computer Ethics and Professional Responsibility. Edited by Terrell W Bynum and S Rogerson. Blackwell Publishing

[12] Tavani, H., 2002, The uniqueness debate in Computer Ethics: What exactly is at issue, and why does it matter?, Ethics and Information Technology 4: 37–54

[13] Curriculum Guidelines for Undergraduate Degree Programs in Software Engineering, A Volume of the Computing Curricula Series SE2004 http://sites.computer.org/ccse/

[14] http://www.computer.org/education/cc2001/index.htm Computing Curricula 2001

[15] http://www.ele.uri.edu/People/Faculty/daly/criteria.2000.html Accreditation Board for Engineering and Technology (ABET) Engineering Criteria 2000 Third Edition

[16] http://www.scu.edu/ethics/practicing/decision/framework.html, A Framework for Ethical Decision Making

[17] http://www.asce.org/inside/codeofethics.cfm American Society of Civil Engineers Code of Ethics

[18] http://www.acm.org/constitution/code.html ACM Code of Ethics and Professional Conduct

[19] www.ieee.org/about/whatis/code.html IEEE Code of Ethics

[20] http://www.computer.org/tab/seprof/code.htm Software Engineering Code Of Ethics And Professional Practice (Ieee-Cs/Acm Joint Task Force On Software Engineering Ethics And Professional Practices)

[21] http://www.iit.edu/departments/csep/PublicWWW/codes/engineer.html Codes of Ethics for Engineering

[22] http://www.iit.edu/departments/csep/PublicWWW/codes/ Codes of Ethics Online

[23] http://legacy.eos.ncsu.edu/eos/info/computer_ethics/ Ethics in Computing "site map"

[24] http://www.idt.mdh.se/kurser/cd5590/

[25] 27th International Conference on Software Engineering, 2005, Education & Training Reports, http://www.cs.wustl.edu/icse05/ConferenceProgram/Tracks/EducationReports.shtml

[26] http://www.nap.edu/readingroom/books/obas On Being A Scientist: Responsible Conduct In Research

[27] IEEE-CS-1999, "Software Engineering Code of Ethics and Professional Practice," IEEE-CS/ACM, 1999, http://www.computer.org/certification/ethics.htm

[28] Magnus Larsson, Predicting Quality Attributes in Component-based Software Systems, PhD Thesis, Mälardalen University Press, Sweden, ISBN: 91-88834-33-6, 2004

[29] Stig Larsson, Improving Software Product Integration, Licenciate Thesis, Mälardalen University Press, Sweden, ISBN 91-88834-65-4, 2005

[30] Gordana Dodig-Crnkovic, Thomas Larsson, Game Ethics - Homo Ludens as a Computer Game Designer and Consumer
A special issue of IRIE on e-games, December 2005

[31] Gordana Dodig-Crnkovic, Virginia Horniak , Ethics and Privacy of Communications in Global E-Village, Encyclopedia of Digital Government, 2005, in publishing procedure

[32] Gordana Dodig-Crnkovic, Virginia Horniak, Good to Have Someone Watching Us from a Distance? Privacy vs. Security at the Workplace, Ethics of New Information Technology,
Proceedings of the Sixth International Conference of CEPE 2005

[33] Kim Anttila, Securing Information System Projects Ethically: Arguments For A Professional Ethical Maturity Model, E-CAP 2005, Västerås, Sweden, http://www.idt.mdh.se/ECAP-2005

[34] http://www.microsoft.com/mscorp/twc/default.mspx Microsoft Trustworthy Computing