Abstract - Teaching ethics in undergraduate computing-oriented courses is important because the specific nature of the development and application of software products affects the professional and personal interests of so many people. Two different approaches in teaching ethics for computer science and information systems students are described here. The first approach consists of incorporating ethical concepts into the teaching material of several computing courses. The second approach implements miscellaneous forms of extra class activities. Both approaches can be united through service learning applications related to the respective academic community. The description of practical solutions relevant to the different methods of teaching cyberethics is discussed below.

Index Terms - Teaching ethics, Ethics in computing courses, Ethics in extra class activities, Service learning.

INTRODUCTION

Usually, curricula for undergraduate computing-oriented majors do not offer special courses in ethics [2,3]. Perhaps, the authors designing the contents of these academic programs believe that if students are interested in similar topics, they should select an appropriate course as an elective or core course taught by the philosophy department. Such courses only consider general ethical principles and do not focus on the specific cyberethics nature and practice. Sometimes, students graduate with a little or no knowledge of the ethical precepts needed to cope with specific problems appearing in their everyday interaction with cyberspace. According to [5], “in many cases the node to computer ethics involves little more than instructors telling their students not to copy copyrighted software.” How to teach ethics in undergraduate computing-oriented courses is still a controversial question but a very important one because the development and application of software products impacts the professional and personal lives of so many people [7,9,17].

Two different approaches to teaching ethics for computer science (CS) and information systems (ISs) students are discussed here. The first one consists of incorporating ethical content as a part of the teaching material relevant to several computing courses included in the curricula for both CS majors and ISs majors and taught by the author of this paper during the last five years: Information Technology and Society, Introduction to Microcomputer Applications, CS I and CS II, Introduction to Database Systems, Information Systems, Systems Analysis and Design, Database Systems Development and Applications, and Readings and Projects in CS and ISs. Another way to use both methods is to apply them as service learning components. In all cases, a successful approach would be to let the student discover the respective principle when he or she is in a specific situation and needs to make the right decision [5].

COMPUTER ETHICS IN THE CLASSROOM

Teaching ethics in non-traditional ethics courses represents a challenge for the instructor [13]. The choice of what exactly to teach and how to offer this material to the audience raises numerous questions. The environmental aspect of the cyberethical behavior forces the CS and ISs students to find immediate solutions. They should know the “principles of right and wrong that can be used by individuals acting as free moral agents to make choices to guide their behavior” [12]. How do you teach these principles and norms while not being viewed as simply imposing new rules to add to the existing guidelines already controlling our life?

A variety of methods have been used to attract the students’ interest and to get them involved in appropriate activities such as teaching selected topics; case study discussions; the writing of essays and research papers; electronic presentations discussing ethical issues; the creation of ethical codes of conduct for virtual companies as part of respective websites and ISs created by students; the organization of questionnaires and quiz bowl sessions; the development of respective team class projects or individual senior projects.

Below, different practical solutions of introducing ethical and moral aspects of computing in several courses are described.

Information Technology and Society Course

According to [18], “the information age has created a more open society where piracy seems to grow . . . with each technological innovation.” The Internet space became a mirror of the individual behavior. A significant part of presence in the cyberspace belongs to the young people who enthusiastically use all possible opportunities offered for information search.

The Information Technology and Society course is offered primarily to students who intend to select a major, a minor, or
a concentration related to computing. The goal of the course is to prepare the students to use information technology (IT) in their academic work during the ensuring years spent at the college and to show them the respective recommended ethical principles that should guide them as members of society when using IT methods and tools.

Students’ attention is focused on the seven factors [10] that challenge the moral codes of the computerized society: speed, privacy and anonymity, nature of medium, aesthetic attraction, increased availability of potential victims, international scope and the power to destroy.

Teaching students how to write papers as part of their academic assignments is an important goal of the class work. In the concrete case, the individual and team papers are oriented toward discussions of basic ethical issues such as intellectual property and rights, privacy and security, and human factors. All of these are relevant to the usage of computers and software development. Special attention is paid to the concept of copyright and corresponding international and US laws. While researching an appropriate area, students have to evaluate the considered moral dilemma an unbiased manner and rely on logic and evidence factors. All students are required to write essays on the topics “Pirated Software. Do I know it?” and “Is My Computer a Health Hazard?” and are to include quantitative and qualitative estimation of research elements on related ethical issues.

Starting at the beginning of the semester, students develop an individual progressive paper choosing their own concrete topics about moral dilemmas relevant to computers. Below, several topics that were selected by students are listed:

- Biologically based computers. How will they change our society?
- Computers and IT – forces of evil.
- Computers and the human interaction of tomorrow.
- Computers own my life – should I agree with this?
- Interactive multimedia: eye, ear, hand, and mind. Does it kill the children’s imagination and creativity?
- Human beings – slaves or leading force in the machines’ world of tomorrow?
- My unlimited virtual life versus my lonely real life: what is my choice?
- Open source software: pros and cons.
- Sharing the Earth with truly intelligent beings of our own creation? Why and why not?

The development of the progressive paper is useful not only for the students but also for the instructor who can better understand students’ individual perceptions and reasoning, and with that understanding orient the discussions in a preferred direction.

Other forms of teaching and assessment are also used in this course. Some of them are considered below.

Discussing case studies by analyzing and judging appropriate real and imaginary situations is very helpful because of the strong impression and influence left by the concrete example of human behavior and associated consequences offered in the considered case. Internet news sources, together with other kinds of media, offer interesting opportunities for this. After such classes, students are able to consider ethical issues related to personal information uploaded to the WWW or to the search for online products or services. Usually, the respective case studies involve individual or team electronic presentations.

Another way of teaching ethical behavior is explored by assigning team projects consisting of creating a website for a virtual company and writing a corresponding ethics code of conduct for the employees of this company. The text adopted by the Association for Computing Machinery and uploaded on the organization’s website [20] is a good example for such an ethic code to be used as a prototype.

Quiz Bowl questions raising ethical problems and providing appropriate knowledge are interesting to students. Such non-traditional classes are preferred by them because of the competitive atmosphere, the opportunity to learn curious entertaining facts from the respective area of study and to contribute to the class activity portion of the final grade.

Traditional lectures on selected ethics topics are also presented by the instructor to complete the introduction of ethical concepts and principles in the course content.

The knowledge gained from this course should allow for better understanding of social context when using IT in everyday activities and when preparing their assignments regardless of academic discipline. Students are expected to acquire a good background for making decisions related to concepts such as intellectual property, usage of open-source software, copyright and related plagiarism problems, on-line communication, privacy protection and privacy-enhancing technologies, information security, computer crimes, on-line identification, biometric identification, legal issues and societal implications.

Other CS and ISs Courses

The rest of the required courses mentioned above offer limited opportunities to teach ethical concepts and principles because of the wide range of topics that have to be covered in a given time. Nowadays, most of the publishing companies offer a variety of textbooks appropriate to be used in different disciplines and include chapters on social and ethical issues related to multilateral computer aspects [1, 3, 6, 8, 11, 12, 14-16].

The nature of the material taught in CS and ISs courses allows the instructor to orient the focus on ethical and moral issues related to software development. When students start writing and designing their own programs, they are advised to think that programs should be understandable for other users. Students also need to think what the social impact of their software products could be. Initiating discussions about copyright concepts is also appropriate. Students should also have skills in protecting their programs by using security techniques related to the respective hardware and software environment used.
Considering ethics issues is appropriate in the *Information Systems* course. The textbook adopted for this course [12] offers a model for thinking about ethical, social, and political issues related to ISs by discussing the following moral dimensions: information rights and obligations, property rights, accountability and control, system quality, and quality of life. Students can learn about the basic rules that determine the decision making: Immanuel Kant’s Categorical Imperative, Descartes’ rule of change, Utilitarian Principle, Risk Aversion Principle, and of course, the ethical “no free lunch” rule. A valuable advantage of this textbook is the presence of multiple case studies that provoke detailed analysis and critical thinking. At the end of this course, students know the answers to the following questions [12]:

- What ethical, social, and political issues are raised by ISs?
- Are there specific principles for conduct that can be used to guide decisions about ethical dilemmas?
- Why does contemporary ISs technology pose challenges to the protection of individual privacy and intellectual property?
- How have ISs affected everyday life?
- How can organizations develop corporate policies for ethical conduct?

In the rest of the courses, different ways of incorporating ethical issues are also used. The *Readings and Projects in CS and ISs* course allows students to prove that they are able to develop valuable senior projects. Some of them have researched topics such as database security, copying music, creation of an IS that supports the protection of natural resources (birds and plants), or an IS used by teachers and parents for tracking the performance of high school students, and others.

**Computer Ethics Outside the Classroom**

The second approach implements miscellaneous forms of extra class activities involving active student participation.

The *Seminar of ISs* was founded three years ago by the author of this paper and is organized periodically for students having special interests in computing. Some of the students are intrigued by research topics belonging to the area of computer ethics such as: database security, Internet piracy, history of hacking, problems rose by virtual reality applications, ecological ISs, plagiarism when developing assignments, legal aspects of the copyright, biometrical identification, etc. The ISs seminar is the forum where students developing the required senior project can share their preliminary results and obtain valuable suggestions and even help. Sometimes, faculty and invited IT professionals offer their support to the seminar by providing talks and tutorials on the fair use of copyright by underlining the four respective factors [15]: the character of use; the nature of the work to be used; the amount of the work to be used; and the effect it would have on the market for the original work or for permissions.

Another form to offer appropriate intriguing information about copyright, software and music downloading restrictions and regulations is represented by the *information board on ISs*.

*Field trips* to external companies and organizations are enjoyable for students. According to the expertise of Computerworld, for 2003, Hershey Foods Corporation is the #1 company that offers outstanding conditions for IT workers and #7 among the US companies introducing IT in its business. In the fall semester of 2003, a field trip to the data center of this company was initiated for students attending the *ISs* course. The tour in the computer center was exciting and the following two-hour discussion with managers of the data center proved how useful similar contacts could be. A significant number of questions discussed were related to ethical aspects of the IT implementation in the company’s business. Students were interested to find out how many hacker attacks the company’s websites have, if any, how the information resources are protected, how the patents and trade marks have been obtained, what the company’s culture is, what the ethical relationships among employees at different levels are, why the company is #1, etc.

Computer ethics issues are important not only for students but also for faculty. An excellent opportunity to attract their attention consists of *Faculty Forum presentations* organized on-campus for faculty and students. In 2003, two presentations including ethical considerations were offered. The title of the first was “Cyberethics. Ethical and Social Impact of Information Systems”. The second one was “The Birth of the Digital Computer” related to the 100th anniversary of John Atanasoff’s birth, whose ideas led to the development of the first digital computer ENIAC and ensuing ethical controversy computer history.

**Ethics and Service Learning**

According to [19], *service learning* represents “a method under which students learn and develop through active participation in thoughtfully organized service experiences that meet actual community needs, and which are coordinated with a formal educational institution to address and support an academic curriculum.”

A wide range of possibilities to incorporate ethics in service-oriented activities exists. A natural way to teach ethics in class is by developing service-oriented projects. One example undertaken by the students attending the *Systems Analysis and Design* course is described here.

A team project assigned to all students attending this course was intended to consider aspects of systems design and documentation [16]. Choosing an appropriate area of the project application was challenging. All students should be motivated to be able to do their best in the respective work. At this time, it was a good coincidence that the Campus Life Council made the decision that a project providing extensive handicapped-related information would be extremely beneficial to those in need. The end result was intended to provide a wide range of useful materials. The instructor of the...
above course took the chance to organize such a project. Students studied all of the buildings on campus to determine their accessibility. They arranged detailed floor plans of the buildings using appropriate software tools to provide visual

The results from the team project have been used in the development of a comprehensive student project. A website offering on-line handicapped information about campus buildings, facilities, and parking areas was designed and developed. A corresponding IS containing all results was also created. The effort spent for the project led to a valuable experience for the students. They learned different lessons, some of which related to computer ethics. These include: how to create a software product representing intellectual property of a team consisting of IT professionals; what the respective responsibilities are; who is liable for problems that might appear because of possible errors; who the real owner of the results is if the equipment and the software used belong to the college; how to collaborate with representatives of college offices, departments, and committees (Campus Life Council, Plant Operations, Admissions Office, and Information Technology Services) in researching the needed information; what it feels like to be involved in something useful to the college community and to have the corresponding appreciation as a feedback. All tasks accomplished for this project represented ethics in action: the goal of the project, the way teams interacted, the group support for the individual comprehensive project; the collaboration with other college departments and offices, the deserved satisfaction that something valuable was accomplished. The impact of the project was significant. It was reported as a project of the Campus Life Council. The results obtained in the project were used in the virtual tour of the college campus for the new college website. The information gathered was found to be a very useful source of information about the on-campus handicapped accessibility by the Landscaping Committee in the development of official campus maps. Current and prospective handicapped students can now obtain a booklet containing the needed information about campus handicapped accessibility.

CONCLUSIONS

Integrating ethical content in CS and ISs courses does not allow the proper teaching of all theoretical principles and multilateral details of the cyberethics as a science. However, the author believes that focusing the students’ attention on ethical and moral issues closely related to their academic activity will educate the understanding of the need to act ethically. The experience gained from applying the different information pertaining to entrances, elevators, area parking, departments and offices in each building. In addition, the students estimated times and distances between buildings.

approaches described above in the last several years shows that it is possible to successfully incorporate ethical concepts and principles in computing courses if no special ethics courses are required according to the respective curricula. CS and ISs students who know and understand the basic concepts and principles relevant to computer ethics are likely to act in the socially responsible way, being well prepared IT professionals.

REFERENCES

[15] Ricardo, Catherine. Databases Illuminated, Jones and Bartlett, 2004