Social and Professional Issues (SP)

Although technical issues are obviously central to any computing curriculum, they do not by themselves constitute a complete educational program in the field. Students must also develop an understanding of the social and professional context in which computing is done.

This need to incorporate the study of social issues into the curriculum was recognized in the following excerpt from Computing Curricula 1991 [Tucker91]:

Undergraduates also need to understand the basic cultural, social, legal, and ethical issues inherent in the discipline of computing. They should understand where the discipline has been, where it is, and where it is heading. They should also understand their individual roles in this process, as well as appreciate the philosophical questions, technical problems, and aesthetic values that play an important part in the development of the discipline.

Students also need to develop the ability to ask serious questions about the social impact of computing and to evaluate proposed answers to those questions. Future practitioners must be able to anticipate the impact of introducing a given product into a given environment. Will that product enhance or degrade the quality of life? What will the impact be upon individuals, groups, and institutions?

Finally, students need to be aware of the basic legal rights of software and hardware vendors and users, and they also need to appreciate the ethical values that are the basis for those rights. Future practitioners must understand the responsibility that they will bear, and the possible consequences of failure. They must understand their own limitations as well as the limitations of their tools. All practitioners must make a long-term commitment to remaining current in their chosen specialties and in the discipline of computing as a whole.

The material in this knowledge area is best covered through a combination of one required course along with short modules in other courses. On the one hand, some units listed as core—in particular, SP2, SP3, SP4, and SP6—do not readily lend themselves to being covered in other traditional courses. Without a standalone course, it is difficult to cover these topics appropriately. On the other hand, if ethical considerations are covered only in the standalone course and not "in context," it will reinforce the false notion that technical processes are void of ethical issues. Thus it is important that several traditional courses include modules that analyze ethical considerations in the context of the technical subject matter of the course. Courses in areas such as software engineering, databases, computer networks, and introduction to computing provide obvious context for analysis of ethical issues. However, an ethics-related module could be developed for almost any course in the curriculum. It would be explicitly against the spirit of the recommendations to have only a standalone course. Running through all of the issues in this area is the need to speak to the computer practitioner's responsibility to proactively address these issues by both moral and technical actions.

The ethical issues discussed in any class should be directly related to and arise naturally from the subject matter of that class. Examples include a discussion in the database course of data aggregation or data mining, or a discussion in the software engineering course of the potential conflicts between obligations to the customer and obligations to the user and others affected by their work. Programming assignments built around applications such as controlling the movement of a laser during eye surgery can help to address the professional, ethical and social impacts of computing.

There is an unresolved pedagogical conflict between having the core course at the lower (freshman-sophomore) level versus the upper (junior-senior) level. Having the course at the lower level

1. Allows for coverage of methods and tools of analysis (SP3) prior to analyzing ethical issues in the context of different technical areas
2. Assures that students who drop out early to enter the workforce will still be introduced to some professional and ethical issues.

On the other hand, placing the course too early may lead to the following problems:

1. Lower-level students may not have the technical knowledge and intellectual maturity to support in-depth ethical analysis. Without basic understanding of technical alternatives, it is difficult to consider their ethical implications.
2. Students need a certain level of maturity and sophistication to appreciate the background and issues involved. For that reason, students should have completed at least the discrete mathematics course and the second computer science course. Also, if students take a technical writing course, it should be a prerequisite or corequisite for the required course in the SP area.
3. Some programs may wish to use the course as a "capstone" experience for seniors.

Although items SP2 and SP3 are listed with a number of hours associated, they are fundamental to all the other topics. Thus, when covering the other areas, instructors should continually be aware of the social context issues and the ethical analysis skills. In practice, this means that the topics in SP2 and SP3 will be continually reinforced as the material in the other areas is covered.

SP. Social and Professional issues (16 hours)
  SP/HistoryOfComputing [core]
  SP/SocialContext [core]
  SP/AnalyticalTools [core]
  SP/ProfessionalEthics [core]
  SP/Risks [core]
  SP/SecurityOperations [elective]
  SP/IntellectualProperty [core]
  SP/PrivacyAndCivilLiberties [core]
  SP/ComputerCrime [elective]
  SP/EconomicsOfComputing [elective]
  SP/PhilosophicalFrameworks [elective]

SP/HistoryOfComputing [core]
Minimum core *coverage time: 1 hour*

Topics:
- Prehistory—the world before 1946
- History of computer hardware, software, networking
- Pioneers of computing

Learning Objectives:
1. List the contributions of several pioneers in the computing field.
2. Compare daily life before and after the advent of personal computers and the Internet.
3. Identify significant continuing trends in the history of the computing field.

SP/SocialContext [core]
Minimum core *coverage time: 3 hours*

Topics:
- Introduction to the social implications of computing
- Social implications of networked communication
- Growth of, control of, and access to the Internet
- Gender-related issues
- Cultural issues
- International issues
- Accessibility issues (e.g. underrepresentation of minorities, women and the disabled in the computing profession)
- Public policy issues (e.g. electronic voting)

Learning Objectives:
1. Interpret the social context of a particular implementation.
2. Identify assumptions and values embedded in a particular design including those of a cultural nature.
3. Evaluate a particular implementation through the use of empirical data.
4. Describe positive and negative ways in which computing alters the modes of interaction between people.
5. Explain why computing/network access is restricted in some countries.
6. Indicate the role of cultural issues in considering team-work.
7. Analyze the role and risks of computing in the implementation of public policy and government (e.g. electronic voting).
8. Articulate the impact of the input deficit from diverse populations in the computing profession.

SP/AnalyticalTools [core]
Minimum core *coverage time: 2 hours*

Topics:
- Making and evaluating ethical arguments
- Identifying and evaluating ethical choices
- Understanding the social context of design
- Identifying assumptions and values

Learning Objectives:
1. Analyze an argument to identify premises and conclusion.
2. Illustrate the use of example, analogy, and counter-analogy in ethical argument.
3. Detect use of basic logical fallacies in an argument.
4. Identify stakeholders in an issue and our obligations to them.
5. Articulate the ethical tradeoffs in a technical decision.

SP/ProfessionalEthics [core]
Minimum core *coverage time: 3 hours*

Topics:
- Community values and the laws by which we live
- The nature of professionalism (including care, attention and discipline, fiduciary responsibility, and mentoring)
- Keeping up-to-date as a professional (in terms of knowledge, tools, skills, legal and professional framework as well as the ability to self-assess and computer fluency)
- Various forms of professional credentialing and the advantages and disadvantages
- The role of the professional in public policy
- Maintaining awareness of consequences
- Ethical dissent and whistle-blowing
- Codes of ethics, conduct, and practice (IEEE, ACM, SE, AITP, and so forth)
- Dealing with harassment and discrimination
- "Acceptable use" policies for computing in the workplace
- Healthy computing environment (ergonomics)

Learning Objectives:
1. Identify progressive stages in a whistle-blowing incident.
2. Specify the strengths and weaknesses of relevant professional codes as expressions of professionalism and guides to decision-making.
3. Identify ethical issues that arise in software development and determine how to address them technically and ethically.
4. Develop a computer use policy with enforcement measures.
5. Analyze a global computing issue, observing the role of professionals and government officials in managing the problem.
6. Evaluate the professional codes of ethics from the ACM, the IEEE Computer Society, and other organizations.
7. Describe the mechanisms that typically exist for a professional to keep up-to-date.
8. Identify the social implications of ergonomic devices and the workplace environment to people's health.

SP/Risks [core]
Minimum core *coverage time: 2 hours*

Topics:
- Historical examples of software risks (such as the Therac-25 case) Implications of software complexity
- Risk assessment and risk management; risk removal, risk reduction and risk control

Learning Objectives:
1. Explain the limitations of testing as a means to ensure correctness.
2. Describe the differences between correctness, reliability, and safety.
3. Discuss the potential for hidden problems in reuse of existing components.
4. Describe current approaches to managing risk, and characterize the strengths and shortcomings of each.

5. Outline the role of risk management in systems design and construction.

SP/SecurityOperations [elective]

Topics:
- Physical security
- Physical access controls
- Personnel access controls
- Operational security
- Security policies for systems/networks
- Recovery and response
- Dealing with problems (both technical and human)

Learning Objectives:
1. Develop an incident-recovery plan for handling system compromises for an organization
2. Analyze stated security procedures for "weak points" that an attacker could exploit, and explain how they could (or will) fail
3. Propose appropriate security measures for different situations
4. Explain to a non-security community of users what measures they must follow and why, in a situation where their jobs are not security-related

SP/IntellectualProperty [core]
Minimum core *coverage time: 3 hours*

Topics:
- Foundations of intellectual property
- Copyrights, patents, and trade secrets
- Software piracy
- Software patents
- Transnational issues concerning intellectual property

Learning Objectives:
1. Distinguish among patent, copyright, and trade secret protection.
2. Discuss the legal background of copyright in national and international law.
3. Explain how patent and copyright laws may vary internationally.
4. Outline the historical development of software patents.
5. Discuss the consequences of software piracy on software developers and the role of relevant enforcement organizations.

SP/PrivacyAndCivilLiberties [core]
Minimum core *coverage time: 2 hours*

Topics:
- Ethical and legal basis for privacy protection
- Ethical and legal framework for freedom of information
- Privacy implications of database systems (e.g. data gathering, storage, and sharing, massive data collecting, computer surveillance systems)
- Technological strategies for privacy protection
- Freedom of expression in cyberspace
- International and intercultural implications

Learning Objectives:
1. Summarize the legal bases for the right to privacy and freedom of expression in one's own nation and how those concepts vary from country to country.
2. Describe current computer-based threats to privacy.
3. Explain how the Internet may change the historical balance in protecting freedom of expression.
4. Describe trends in privacy protection as exemplified in technology.

5. Clarify the apparent conflict between the requirements of freedom of information and the protection of the rights of the individual.

SP/ComputerCrime [elective]

Topics:
- History and examples of computer crime
- "Cracking" ("hacking") and its effects
- Viruses, worms, and Trojan horses
- Identity theft
- Crime prevention strategies

Learning Objectives:
1. Describe trends in privacy protection as exemplified in technologyOutline the technical basis of viruses and denial-of-service attacks.
2. Enumerate techniques to combat "cracker" attacks.
3. Discuss several different "cracker" approaches and motivations.
4. Identify the professional's role in security and the tradeoffs involved.
5. Indicate measure to be taken both by individuals themselves and by organizations (including government) to prevent identity theft.

SP/EconomicsOfComputing [elective]

Topics:
- Monopolies and their economic implications
- Effect of skilled labor supply and demand on the quality of computing products
- Pricing strategies in the computing domain
- The phenomenon of outsourcing and offshoring; impacts on employment and on economics
- Differences in access to computing resources and the possible effects thereof
- Environmental sustainability

Learning Objectives:
1. Summarize the rationale for antimonopoly efforts.
2. Describe several ways in which the information technology industry is affected by shortages in the labor supply.
3. Suggest and defend ways to address limitations on access to computing.
4. Outline the evolution of pricing strategies for computing goods and services.
5. Discuss the benefits, the drawbacks and the implications of offshoring and outsourcing.
6. Identify ways to support environmental computing (e.g. green operations, recyclable products, reduced green house emissions).

SP/PhilosophicalFrameworks [elective]

Topics:
- Philosophical frameworks, particularly utilitarianism and deontological theories
- Problems of ethical relativism
- Scientific ethics in historical perspective
- Differences in scientific and philosophical approaches

Learning Objectives:
1. Summarize the basic concepts of relativism, utilitarianism, and deontological theories.
2. Recognize the distinction between ethical theory and professional ethics.
3. Identify the weaknesses of the "hired agent" approach, strict legalism, naïve egoism, and naïve relativism as ethical frameworks.