DOCUMENT RESUME

ED 396 692 IR 017 868

AUTHOR Pulliam; Sylvia Clark
TITLE Ethics and Computer Scientists.
PUB DATE 94
NOTE 10p.; In: Recreating the Revolution. Proceedings of the Annual National Educational Computing Conference (15th, Boston, Massachusetts, June 13-15, 1994); see IR 017 841.
PUB TYPE Reports - Research/Technical (143) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Computer Science; *Educational Practices; *Ethical Instruction; Higher Education; *Surveys; Tables (Data); *Teacher Attitudes; Teaching Methods
IDENTIFIERS *Computer Ethics; *Computer Use; Kentucky

ABSTRACT

The purpose of this study was to explore the perceptions that computer science educators have about computer ethics. The study focused on four areas: (1) the extent to which computer science educators believe that ethically inappropriate practices are taking place (both on campus and throughout society); (2) perceptions of such educators about which practices in computer science have ethical connotations; (3) the extent to which such educators perceive that computer ethics are an appropriate topic to be addressed in computer science classes and which topics with ethical implications should be taught in the classroom; and (4) what teaching methods should be used if computer ethics is taught at the college level. Respondents included 87 (out of 144 surveyed) full-time faculty members who teach computer science classes at colleges and universities in the state of Kentucky. Seven tables reflect survey responses. (AEF)

Paper (W3-201B)

Ethics and Computer Scientists

Sylvia Clark Pulliam
Computer Science Department
Western Kentucky University
Bowling Green, Kentucky 42101
(502)745-6186
(502)586-3797 (home)
pulliam@wkuvxl.wku.edu

Keywords: ethics, education, computer science, values, curriculum

Abstract

This study undertook to determine whether computer science educators agreed that computer ethics should, or could, be taught; and, if so, the topics to include and the best method for teaching computing ethics.

Most educators agreed that computer ethics could and should be taught at the college level, by computer science educators, using a variety of teaching techniques, especially lecture and case studies.

Introduction

The account of a Cornell University computer science student who brought computer systems at MIT and other universities, the RAND Corporation, and NASA to a grinding halt (Forester & Morrison 1990, p. 57) was an extreme example of the potential for wrongdoing when misusing a computer. While the potential has always existed for unethical use of computers, the widespread use of computer networks has greatly magnified the potential harm that such unethical computer use can generate.

In light of a concern about the possibility of utilizing computer technology for unethical means, the Computer Science Accrediting Board (CSAB) has required that colleges and universities must be able to document that computer ethics and values are included in the curriculum in order to receive CSAB accreditation. Most schools must change their curriculum to assure that they include a discussion of ethics and values for CSAB accreditation.

Computer ethics includes an assortment of concerns: software piracy; invasion of privacy; inaccurate data, either through sloppy validation procedures or deliberate misrepresentation of data; use of computers to commit a variety of crimes, such as embezzlement; and computer viruses, our newest highly-publicized concern. But there is no real agreement on the definition of computer ethics, what concerns it encompasses, or whether it can or should be taught in the college classroom.

Even among those who feel strongly that computer ethics can and should be taught in the classroom, there are differences of opinion as to whether these topics should be taught in a separate course or integrated within the computer science curriculum. A course emphasizing computer ethics is likely to look at the larger area of societal issues in computer applications (Gotterbarn, 1991). It probably includes reading of several treatises on the topic and a good deal of classroom discussion. It may also include students writing about the topics read and discussed and a practical application of the principles covered in the classroom.

Ethical Implications of Computers

Computers are tools which can have a tremendous impact on lives, either positive or negative. Used properly, sophisticated computer data bases can aid in apprehending dangerous criminals (Shannon, 1987) or in protecting government agencies from individuals who are abusing the system. But abuse of data base searches, often in the form of uninformed negligence, can cause innocent people to lose their welfare payments, be denied credit, receive threats over other people's obligations, and even be imprisoned wrongly (Davis, 1987). Artificial intelligence, one branch of computer science, can be used to provide sophisticated, user friendly teaching aids for students, or the same technology can be used to guide missiles capable of annihilating entire populations (Weizenbaum, 1986).

Society can not afford to worship the computer blindly nor to denigrate it prejudiciously. The potential for unethical behavior in the use of a computer seems to be clear, whether we are talking about large issues such as the planning of nuclear war, clearly criminal cases such as embezzlement, or more subtle issues such as reading another's personal data without permission. The question remains, however, as to how we should deal with computer ethics in the classroom.

Purpose of the Study

The purpose of this study was to explore the perceptions that computer science educators have about computer ethics. In the field of computer science, almost every topic of discussion is still a relatively new one. But ethical conduct is an ancient concept which has dictated standards of behavior for thousands of years. In particular, the opinions of college-level computer science instructors were examined in order to find a common ground on how ethics should be applied within the new technology of computer science.

Questions to Guide the Study

The following questions guided this study of computer ethics:

1. To what extent do computer science educators believe that ethically inappropriate practices are taking place (both on their own campus and throughout society generally)?

2. What are the perceptions of computer science educators about which practices in computer science have ethical connotations?

3. To what extent do computer science educators perceive that computer ethics are an appropriate topic to be addressed in computer science classes? Which topics with ethical implications should be taught in the classroom?

4. If computer ethics is taught at the college level, what teaching methods should be used?

Population and Sample

All 144 full-time faculty members who teach computer science class es in any college or university in the author's state which offers a bachelor's degree with a major or minor in computer science were surveyed. Computer related courses are taught under a variety of titles i a wide range of departments. Therefore, the sample was found in depart ments such as computer science, finance and management information systems, math and computer science. computer studies, computer information systems, and engineering math and computer science. They may be i the college of arts and sciences, business, engineering, or science, technology, and health.

Responses were received from all eight state universities and 11 church-related and private schools. The 87 faculty members who respond ed to the first request or within three weeks of the second mailing mad up the sample.

Analysis of Data

The analysis of data is divided into four parts, each one corresponding to a research question that guided the study. The instrument itself is divided into a section for demographic data followed by three parts intended to answer the guiding research questions. The first par asked general questions about computer ethics and computer ethics educa tion. Questions in Part II were predicated on the assumption that the respondent has been given the authority to design a computer ethics course. The third part provided the participant with an opportuniy for open-ended responses.

Question 1

To what extent do computer science educators believe that ethicall inappropriate practices are taking place?

Educators were asked whether they believed that computer ethics is a problem globally and at their institution. The answer to both these questions was yes, but to varying degrees. Seventy-two (85%) of the

respondents felt that computer ethics was a global problem, but only 44 (54%) considered computer ethics a problem at their institution.

Participants indicated the extent to which they felt that ethically inappropriate computer practices are commonly taking place among certain groups (Table 1). Possible responses were strongly agree, agree, neutral or no opinion, disagree, or strongly agree. Means analysis was performed after assigning numeric values to responses, giving 5 for strongly agree, down to 1 for strongly disagree. For each group of people mentioned, the mean value was more than 3.0. The general consensus was that students are more likely to engage in unethical practices than faculty. Computer science students were ranked highest, with a mean of 3.80, followed by other college and university students, with a mean of 3.64. Faculty members were ranked as the least likely to behave unethically, with a mean of 3.31 for non-computer science faculty, and only 3.04, for computer science faculty.

Group	SA Freq %	AFreq %	*N* Freq %	D Freq %	SD Freq %	Mean	Std Dev
C.S. students	13-15	51-60	14-7	5-6	2-2	3.80	0.86
Other college & university students	13-15	42-49	18-21	10-12	2-2	3.64	0.96
Individuals who use computers as part of their jobs	10-12	42-50	24-29	7-8	1-1	3.63	0.85

Operators of bulletin board systems	1619	28 33	33 39	6 7	1 1	3.62	0.91
Computer professionals in business & industry	2-14	39 46	21 25	11 13	1 1	3.60	0.93
Computer clubs or local interest groups	12-14	32 38	32 38	6 7	2 2	3.55	0.91
other faculty	10-12	24 29	38 45	9 11	4 5	3.32	0.98
computer science faculty	5 6	21 25	36 42	18 21	5 6	3.04	0.97

Table 1 Extent of Unethical Practices: Indicate the extent to which you feel that ethically inappropriate computer practices are commonly taking place among the following groups.

Question 2

What are the perceptions of computer science educators about which practices in computer science have ethical connotations?

Two instrument items addressed this question. The first presented 25 topics and asked each person surveyed to "indicate the extent that you feel each topic is an important ethical issue." Topics were rated from severe issue to not an issue. Values were assigned for this item, with 5 for a severe issue down to 1 for not an issue A free-form question in Part III asked about the respondent's observation of inappropriate computer practices.

I A mean was calculated for each suggested topic, ranging from highs of 4.28 for accessing confidential databanks and 4.27 for copying commercial software to lows of 2.57 for boredom from routine and 2.56 for computer aided instruction (Table 2). More than half (minimum of 46) of those surveyed felt that 23 of the 25 topics were at least a moderate issue. Fifteen topics had a mean response of more than 3.0.

Four people responded none or zero to the question, "In your teaching of computer science, what unethical situations have you encountered?" Another 13 gave no response to the question, which was interpreted to mean that they had not encountered any unethical situations. About half of the respondents (43) named one unethical situation they had encountered. Others mentioned as many as eight different situations, with one given as "and lots more." The overall mean was 1.36 situations. Similar responses were grouped together for purposes of analysis. The largest group (41, or 47%) listed piracy or copying of copyrighted software as unethical situations that they had encountered. Another 33 (38%) listed plagiarism and cheating, such as copying another student's programs or homework. Hacking and/or security violations were mentioned by 14 people, or 16% of those surveyed.

Topic	Frequency							
	5	4	3	2	1	Mean	Std Dev	Rank*
h)Accessing confidential databanks	45	23	14	2	1	4.28	0.908	1
g)Copying commercial software	39	33	10	3	0	4.27	0.808	2
v)System security	33	33	16	1	1	4.14	0.852	3
f)Use of computers to commit crimes	39	27	13	4	2	4.14	1.002	4
t)Viruses and worms	28	36	15	5	1	4.00	0.926	5
u)Monitoring electronic mail	21	37	21	5	1	3.85	0.906	6
x)Electronic transfer of funds	23	34	16	6	6	3.73	1.148	7
w)Networks	17	38	18	8	3	3.69	1.018	8

i)Validity of data(GIGO)	18	29	30	6	2	3.65	0.972	9
y)Military applications	25	27	17	9	7	3.64	1.243	10
j)Reliability of software	15	30	30	7	3	3.55	0.994	11
l)Adult hackers	18	27	22	18	0	3.53	1.053	12
e)social responsibility	15	29	26	7	7	3.45	1.134	13
b)Databanks on suspected criminals	15	32	20	9	8	3.44	1.186	14
k)Teenage hackers	12	30	25	17	1	3.41	1.003	15
s)"Whistle-blowing"	6	17	36	10	16	2.85	1.160	16
p)On-the-job stress	5	23	20	24	12	2.82	1.163	17
c)Gender-related issues	6	21	27	12	19	2.80	1.242	18
q)Worker displacement resulting from computers	5	18	28	22	12	2.79	1.114	19
n)Potential VDT health risks	6	19	23	23	14	2.76	1.182	20
d)Minority issues	3	21	28	16	17	2.73	1.148	21
a)Effect of computers on socialization skills	5	18	24	22	16	2.69	1.175	22
o)Boredom from routine	3	16	22	28	15	2.57	1.101	24
r)employee loyalty	4	11	31	23	15	2.60	1.077	23
m)Computer Aided Instruction	8	16	16	20	25	2.55	1.341	25

* 1 = highest rank 25 lowest rank

Table 2. Importance of Ethical Issues: Indicate the extent that each topic is an important ethical issue.

Question 3

To what extent do computer science educators perceive that computer ethics is an appropriate topic to be addressed in computer science classes? Which topics with ethical implications should be taught in the classroom?

The great majority of those surveyed believed that computer ethics should be addressed in some manner at the university level, but there was less agreement on requiring a computer ethics course or including

computer ethics in the curriculum below the university level. Seventyeight (92%) of those responding, agreed that a school or department should develop and publish its own computing ethics policy. Even more people (77, or 94%), believed that the ethical use of computers can be taught.

Most respondents (61, or 70%) indicated that including computer ethics in the curriculum at the college or university level is of extreme importance or great importance (Table 3). A smaller majority (49, or 56%) considered it to be of extreme importance or great importance to include computer ethics at the high school level. Respondents were divided over the importance of including computer ethics in the middle school curriculum and less enthusiastic about including computer ethics at the elementary school level, ranked to be of extreme or great importance by 30% and 24%, respectively.

When not pressed for a specific level, four out of five participants agreed or strongly agreed that we should teach computer ethics in a classroom setting. Almost as many agreed or strongly agreed that an institution with an ethics course should ask faculty to discuss the topic in other courses as well. There was no such consensus about whether a computer ethics course should be required (Table 3).

	SA Freq %	A Freq %	N Freq %	D Freq %	SD Freq %	Mean	Std Dev
Should teach computer ethics in classroom	24 35	31 45	10 15	4 6	0 0	4.09	.85
Should discuss computer ethics in other classes	30 35	36 42	14 17	5 6	0 0	4.07	0.87
Should require course	11 13	17 20	24 28	17 20	16 19	2.88	1.30

* To calculate mean and standard deviation, responses were assigned numeric values: S
A = 5, A = 4, N = 3, D = 2, SD = 1

Table 3. Computer Ethics in a Classroom Setting

The instrument includes a list of possible topics for inclusion in a computer ethics course and asks those surveyed to select the topics that they would include in such a course. Educators selected the topic which they considered the most important. Respondents also were given an opportunity to suggest other topics that they would include in a computer ethics course and to describe computer ethics courses taught at their institutions.

Respondents identified the ethical issues they would like to see integrated into a computer ethics course. For each selected issue, respondents then indicated the teaching method they would like to use to present the topic. Only the selection or rejection of a topic is discussed here; teaching methods are discussed below in the section for question 4.

Eighty educators (96%) agreed that the topic of copying commercial software should be included in a computer ethics course if one were offered (Table 4). Boredom from routine was the least likely to be selected; it was chosen by 32 (41%) of those who responded to the question.

Educators were asked, "From this list, what do you consider the single most important ethical issue facing computer professionals today?" (Table 5). Copying commercial software was named most often, by 18 respondents. Ten people named social responsibility as the single most important ethical issue, 9 selected accessing confidential databanks, and 8 named the use of computers to commit crimes. Fourteen other topics received at least one vote.

Question 4

If computer ethics is taught at the college level, what teaching methods should be used? Which methods should be used on which topics?

From this list, what do you consider the single most important ethical issue facing computer professionals today?

Topic	Freq	%**	Rank*	Votes MostImp
g)Copying commercial software	80	96.4	1	18
t)Viruses and worms	78	95.1	2	4
h)Accessing confidential databanks	77	93.9	3	9
v)System security	76	93.8	4	7
f)Use of computers to commit crimes	75	90.4	5	8
u)Monitoring electronic mail	75	91.5	6	1
e)Social responsibility	67	82.7	7	10

1)Adult hackers	63	79.7	8	2
x)Electronic transfer of funds	63	78.7	10	1
w)Networks	63	77.8	11	1
k)Teenage hackers	61	76.2	12	3
j)Reliability of software	60	75.9	13	3
b)Databanks on suspected criminals	57	70.3	14	
s)"Whistle-blowing"	55	68.7	15	
q)Worker displacement resulting from computers	52	65.9	16	1
a)Effect of computers on socialization skills	51	63.7	17	1
y)Military applications	50	64.1	18	1
n)Potential VDT health risks	44	54.3	19	
p)On-the-job stress	43	54.4	20	
c)Gender-related issues	41	70.3	21	2
r)Employee loyalty	41	51.9	22	
d)Minority issues	36	45.6	23	
m)Computer Aided Instruction	34	43.6	24	
o)Boredom from routine	32	41.0	25	
z)Other	11		26	1

1 = highest rank 25 = lowest rank % based on those who responded for each topic, ranging from 78 to 83

Table 4. Rank Order for Topics for Computer Ethics Course: Indicate the topics from the following list that you would like to see in the computer ethics course.

When asked where to place the teaching of computer ethics, the largest group of respondents (30, or 35%) preferred to include computer ethics "as a separate module in a larger course" (Table 5). The separate module format also received the highest mean value (3.62). The second most popular placement was "through personal example of faculty and staff," with a mean of 3.42 and 24 respondents (28%) selecting it first.

Placement in Curriculum	5 Freq %	4 Freq%	3 Freq %	2 Freq %	1 Freq %	Mean	Std Dev
Course Module	30 35	14 16	24 28	13 15	4-5	3.62	1.34
Example of faculty & staff	24 28	23 27	21 25	10 12	7-8	3.55	1.25
References in C.S. curriculum	12 14	29 34	16 19	24 28	4-5	3.25	1.15
Separate C.S. course	13 15	13 15	11 13	16 19	32-38	2.52	1.50
Ethics course in another dept.	6 7	5 6	20 24	14 17	40-47	2.09	1.26

Table 5. Curriculum Placement for Computer Ethics: Rank the following placements in the curriculum for teaching computer ethics at the college level, with 5 being the highest ranking and 1 being the lowest ranking. (Use each value once.)

Computer science educators believed that they were the group best suited for teaching a computer ethics course, either alone or as part of a team (Table 6). Asked to "rank the following groups according to which you consider the most appropriate for teaching the computer ethics course," respondents ranked computer science faculty first, with a mean of 3.88 and 33 (40%) first-place votes. The choice of a team of computer science and other faculty ran a close second, receiving 32 (38%) first-place votes and a mean of 3.87.

Faculty Group	5 Freq %	4 Freq%	3 Freq %	2 Freq %	1 Freq %	Mean	Std Dev
C.S. faculty	33-39	24-29	16-19	6-7	5-6	3.88	1.18
Team of C.S. & other faculty	32-38	33 39	4-5	6-7	9-11	3.87	1.29
Ethicists	7-8	10 12	28-33	19-23	20-24	2.58	1.21
Philosophy/religion faculty	5-6	13 16	21-25	26-31	19-23	2.51	1.17
Sociology faculty	2 2	6 7	26 31	25 30	25 30	2.23	1.03

Table 6. Appropriate Group to Teach Computer Ethics: Rank the following groups according to which you consider the most appropriate for teaching the computer ethics course, with 5 the highest ranking and 1 the lowest.

In response to instrument the question "At what level should the course on computer ethics be offered?" more than half (46, or 55%) recommended that it be offered to freshmen. The course was generally considered more important at lower levels, with sophomores, juniors, and seniors receiving 28, 18, and 13 responses, respectively. (Some people selected more than one level.)

Method	Frequency								
	7	6	5	4	3	2	1	Mean	Std Dev.
Class discussion of case studies	46	18	9	3	1	3	3	6.01	1.56
Individual assessment of case studies	13	28	15	11	7	7	2	5.00	1.62
Lecture by instructor	15	4	16	11	11	4	23	3.77	2.19
Written reports on research	0	14	10	20	16	19	5	3.63	1.52
Group projects	3	7	12	18	17	19	7	3.50	1.57
Oral reports on research	4	5	15	13	23	10	14	3.43	1.67
Group reports	0	6	14	16	12	14	21	3.07	1.65

Table 7. Preferred Teaching Methods: Rank the following teaching methods to use in teaching a computer

Respondents were asked to "Rank the following teaching methods to use in teaching a computer ethics course" (Table 7). Of the suggested ethics course, with 7 being the highest ranking and 1 the lowest methods, class discussion of instructor-provided case studies was selected by a majority (46, or 55%) as the best method, and also received the highest mean response, of 6.01.

worms, and accessing confidential databanks were ranked as the most important topics to cover. Case studies were selected as the most appropriate means for teaching computer ethics in the classroom, in general. But when asked about the preferred method for

teaching specific topics, lecture edged out case studies, which were still popular. There was also a consensus that more than one teaching method was preferrable.

Interestingly, while computer science faculty members were considered to be a particularly ethical group, their students were considered to be particularly unethical. Perhaps this is attributed to abundance of opportunity without the corresponding maturity and awareness of the issue. Educators agreed that an institution should develop and publish a computing ethics policy.

References

Davis, B. (1987, August 20). As government keeps more tabs on people, false accusations rise. The Wall Street Journal, pp. 1, 12.

Forester, T. & Morrison, P. (1990). Computer ethics: Cautionary tales and ethical dilemmas in computing. Cambridge. Massachusetts: The MIT Press.

Gotterbarn, D. (1991, August). A "capstonell course in computer

ethics. Paper presented at National Conference on Computing and Values, New Haven, CT.

Shannon, E. (1987, May 25). Taking a byte out of crime. Time, p. 63. Weizenbaum, J. (1986, July 17). Not without us. (Talk given to the Gesellschaft fur Informatik, at Karlsruhe, West Germany). Webster, S. (1991, August). Making a code of computer ethics work at Pimli College. Paper presented at National Conference on Computing and Values, New Haven, CT.