Facing Computer Ethics Dilemmas: Comparing Ethical Decision-Making Processes of Students in Computer Science with Non-Computer Science Majors

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Comparing Ethical Decision-Making Processes of Students in Computer Science with Non-Computer Science Majors: Lessons for Teaching Ethics to Undergraduate Students

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Abstract

The aim of this research paper is to understand whether and in what ways undergraduate computer science students decide differently from their peers in other disciplines when facing computing ethics dilemmas. This study expands on previous research on ethical decision making among computing majors. The findings of this research have important implications for research and practice. For example, it examines the arguments from previous literature regarding the differences of ethical decision making among different professions. Moreover, it will have important implications for design of ethics courses in undergraduate level.

The data is collected from two groups of students in a large Midwestern University: (1) 33 computer science undergraduate students enrolled in a course on computing professional ethics, and (2) 40 undergraduate students enrolled in a course on business ethics and law. Although this second course was taught in the college of business, the students were majoring in different fields including advertisement, communication, agriculture, arts, etc. The collected data include both group of students' postings responding to three ethical scenarios in computing and their responses to their peers as part of their regular class activities.

Following a qualitative research design, content analysis was used to analyze the data. The results showed that computer science students, overall, made more ethical decisions when facing computing ethics scenarios. In this paper, the underlying reasons for the decisions made by both groups and implications for teaching ethics to college students will be discussed.

Introduction

As computing systems integrate more and more into our daily lives, understanding the ways in which individuals think and make decisions about computing ethical dilemmas becomes more important. Such understanding, not only provide a picture of current situation, but also will be beneficial for developing interventions to improve it.

This study builds on the assumptions of Bandura's (1986) social cognitive theory, in which, individuals "are neither driven by inner forces nor automatically shaped and controlled by external stimuli" (Bandura, 1986, p. 18). In this view, "[m]oral actions are the products of the reciprocal interplay of personal and social influences" (Bandura, 1999, p. 207).

The goal of this study is to understand the differences and the similarities of the ways in which undergraduate computing majors and non-computing majors think and make decisions about ethical issues. To be more specific, the following research questions will inform the study:

1- Whether and in what ways the ethical decision making processes are different between computer science majors and other undergraduate students?
2- What are the implications of such differences for teaching ethics in undergraduate programs, in particular, and ethical development of computing professionals, in general?

Literature Review

In recent years, more responsibilities are assumed for higher education and organizations regarding promotion of ethics (Foote & Ruona, 2008). While some have raised doubts on the possibility of teaching ethics to adults (Walton, 2003), some other researchers argued for the possibility and effectiveness of teaching ethics (e.g., Davis, 2002; Parks, 1993; Rest, 1994). Davis (2002) stated that "moral development is a continuing process" and ethics cannot be fully taught in early ages. Several empirical research also revealed the effectiveness of ethics courses in increasing students' ethical awareness and improving their ethical judgments (e.g., Lau, 2010). However, there are also studies in the literature that concluded that the ethics courses are not effective (Wynd & Mager, 1989).

Several studies have researched the differences in ethical decision making among members of different professions. For example, McCabe, Dukerich, and Dutton (1991) found that MBA students made less ethical choices compared to their counterparts at Law school. These authors attributed this finding to "the type of person each profession attracts or select" (p. 959). Leavitt, Reynolds, Barnes, Schilpzand, and Hannah (2012) stated that employees' moral judgments are influenced by their occupational identities.

Methods

This research, which is applied in nature and takes a descriptive approach to ethics, was conducted to answer the following research questions:

1- Whether and in what ways the ethical decision making processes are different between computer science majors and other undergraduate students?
2- What are the implications of such differences for teaching ethics in undergraduate programs, in particular, and ethical development of computing professionals, in general?

Participants

The data is collected from two groups of students. First group included 33 undergraduate computer science students enrolled in a course on computing professional ethics in a large Midwestern University. The second group included 40 undergraduate students enrolled in a

course on business ethics and law in the same university. Although the course was taught in the college of business, the enrolled students were majoring in different fields including business, advertisement, communication, agriculture, arts, etc.

Data collection

The collected data include students' postings responding to three ethical scenarios in computing from both groups (i.e., computer science students and non-CS majors) and their responses to their peers as part of their regular class activities during a period of nine weeks (i.e., three weeks of discussion for each scenario).

The ethical scenarios

To conduct this study, three ethical scenarios were designed. In the first scenario, students were asked to imagine they were part of a team who needed to decide on the default option of privacy level for a new social media platform they had developed. The students were then asked whether this decision involved an ethical or an operational issue and also what they would have done if they were in this situation. The second part of this scenario asked students what approach they would take to select trending news (i.e., using algorithms or the opinions of experts). The prompt questions were identical to those in the first part of the scenario.

The second scenario involved software testing. The dilemma in this scenario was to whether extend the deadline to run appropriate tests or deliver the application on time as the manager requested.

The third scenario was about an incident in the first job of a programmer who was hired in an advertising firm. The client company had asked the programmer to design a website for a quiz which, no matter the responses of users, would always recommend the client's manufactured drug. The website was not marked in a way to suggest as an advertisement. The programmer completed the task as was asked and later understood a woman who took the medicine had committed suicide possibly due to the drug's side effects. The students were asked whether this programmer did something wrong in this situation. Also, whether he was responsible for what had happened.

Data analysis

The codes developed from a previous grounded theory research (i.e., the outcome of the analysis of the data from computer science students) was used as initial coding system and new codes were added when necessary. Charmaz (2006) stated that "coding distills data, sorts them, and gives us a handle for making comparisons with other segments of data" (p. 3).

Results and Discussions

To understand the decision making processes of students responding to each of the scenario, in this section, the solutions proposed by these students will be examined.

Students' responses to the issue of privacy in the social media scenario

The solutions that computer science majors provided for the issue of privacy in social media, are categorized as follows: (1) the highest privacy level as the default (17 individuals), (2) allowing the user to select the preferred privacy in the first use (5 individuals)., (3) the lowest privacy level (4 individuals), (4) the lowest privacy level as the default but inform the users (3 individuals), (5) the medium privacy level as the default (1 individual), and (6) other solutions (3 individuals).

While the categories for the non-computer science students' responses were similar to the computer science students' responses, the frequencies were different. The categories for non-computer science students were as follows: (1) the highest privacy level as the default (14 individuals), (2) the lowest privacy level (9 individuals), (3) allowing the user to select the preferred privacy in the first use (5 individuals), (4) the lowest privacy level as the default but inform the users (3 individuals), (5) the medium privacy level as the default (3 individuals), (6) other solutions (4 individuals). The frequencies and percentiles for both groups are provided in Table 1.

Table 1.

Students' solutions for the issue of privacy in social media scenario

The provided solution	**Frequency among Computer science majors (N=33)**	**Frequency among Non-computer science majors (N=40)**
The highest privacy level as the default	17 (51%)	14 (35%)
Allowing the user to select the preferred privacy in the first use	5 (15%)	5 (12.5%)
The lowest privacy level	4 (12%)	9 (22.5%)
The lowest privacy level as the default but inform the users	3 (9%)	3 (7.5%)
The medium privacy level as the default	1 (3%)	3 (7.5%)
Other solutions	3 (9%)	4 (10%)

As one can see, about half of the computer science students believed that the highest privacy should be set as the default. This was only true for 35% of students registered in the business ethics course. In addition, about a fifth of students from the business ethics course believed that the lowest privacy should be set as the default level of privacy. However, this option was selected by around 12% of computer science students. This finding shows that, computer science students were more cautious about the issue of privacy compared to their non-computer science peers. This can be attributed to the knowledge computer science students possessed regarding the

issue of privacy which was reflected in some of computer science students' responses. For example, a computer science student stated:

> *Since you're dealing with people's personal information, as computer scientists having the knowledge of how vulnerable a low privacy setting would make users yet setting that to default would bring questions… why we would do such a thing knowing the consequences. It's our duty to protect users.*

Students' responses to the trending news scenario

Computer science students' responses to the scenario of trending news fell into four categories: (1) using combination of algorithms and team of experts (18 individuals), (2) using a group of experts (7 individuals), (3) abandoning the news (5 individuals), and (4) using algorithms (2 individuals), (5) no solutions provided (1 individual).

Responses from non-computer science students, however, were categorized under the following categories: (1) using combination of algorithms and team of experts (13 individuals), (2) using a group of experts (11 individuals), (3) abandoning the news (11 individuals), (4) using algorithms (2 individuals), and (5) other solutions or no solutions provided (3 individuals).

Table 2.

Students' solutions for trending new in social media scenario

The provided solution	**Frequency among Computer science majors (N=33)**	**Frequency among Non-computer science majors (N=40)**
Using combination of algorithms and team of experts	18 (54.5%)	13 (32.5%)
Using a group of experts	7 (21%)	11 (27.5%)
Abandoning the news	5 (15%)	11 (27.5%)
Using algorithms	2 (6%)	2 (5%)
Other solutions or no solutions provided	1 (3%)	3 (7.5%)

While most students in both groups chose the combined approach, non-computer science majors had a higher tendency to choose the options of abandoning the news and also using a group of experts compared to computer science students. This shows that participating non-computer science students, overall, were less willing to rely on algorithms (even partially) for selecting trending news (37.5% vs. 60.5%). Eight out of nine non-computer science majors who decided to abandon the trending news as the best solutions, argued that the use of news will endanger the perception of company. It is reasonable to assume that for computer science majors, who are closer to the technical aspects of the situation, it was more difficult to think about the bigger picture which is not the case for the other group. The computer science students might have also felt that their decisions should be within the two choices for implementing the trending news rather than deciding not to implement it at all which was for some reason beyond their power. It is interesting, in itself, that for most non-computer science students who decided to abandon the

news, the reasoning was not about the possible harm to users or the importance of truth as an ethical concern.

Students' responses to the app development scenario

The responses of computer science students to this scenario is categorized under six different categories: (1) not signing off before proper testing (14 individuals), (2) Signing off if the software is not safety critical (8 individuals), (3) signing off as the managers want (4 individuals), (4) signing off but let the client know (2 individuals), (5) test overnight for bugs (1 individual), and (6) other solutions or no solution provided (4 individuals).

The categories for the non-computer science majors were somehow different. Here are the identified categories: (1) express the concerns and convince the managers (15 individuals), (2) inform the company about the need for additional time (10 individuals), (3) not signing off before proper testing (4 individuals), (4) signing off as manager wants (4 individuals), (5) test overnight for bugs (2 individuals), and (6) other solutions or no solution provided (5 individuals).

Table 3.

Students' responses to the app development scenario

The provided solution	**Frequency and percentile among computer science majors (N=33)**	**Frequency and percentile among non-computer science majors (N=40)**
Not signing off before proper testing	14 (42.5 %)	4 (10%)
Signing off if the software is not safety-critical	8 (24%)	0
Singing off as the managers want	4 (12%)	4 (10%)
Signing off but let the client know	2 (6%)	0
Inform the client company about the issue	2 (6%)	10 (25%)
Test overnight for bugs	2 (6%)	2 (5%)
Express the concerns and convince the managers	0	15 (37.5%)
Other solutions or no solution provided	1 (3%)	5 (12.5%)

A major difference between the approaches of two groups has to do with the nature of the application. The non-computer science majors did not attend to the nature of the app (safety-critical) as a factor of decision making. Moreover, they were more likely to be willing to use approaches to convince the manager or directly contact the client compared to computer science majors.

Students' Responses to the Jim's scenario

In response to the Jim's scenario, 12 out of 33 students in computer science group believed that Jim did nothing wrong (36%) while this was 30 out of 40 for the students enrolled in the course on business ethics (75%). It means that, overall, computer science majors made more ethical decisions in this scenario. The reasons each of these groups provided can help us understand the underlying reasons for this discrepancy. 26 out of 30 student in the class on business ethics provided arguments around the following three statements: (1) Jim did his job, (2) he is just a coder, or (3) he did what he was asked to do. The reasons from the other group, computer science majors who also believed Jim did nothing wrong, were on the similar line.

The reasons non-computer science who stated that Jim wrong provided were around two ideas: (1) negative consequences for the girl who took the medicine, and (2) Knowingly designing a faulty quiz. For computer science students, the reasoning was more diverse. In addition to the reasons provided by non-computer science majors, some of the computer science majors used the story of scientists who worked for Nazis to argue the responsibility of Jim for questioning what he has asked to do. This story was shared with them during one of the course lectures. Also, some of them used the example of websites such as buzzfeed that provide information regarding being advertisement when implementing online quizzes.

Conclusions and Implications

Overall, the findings showed that the computer science majors who participated in this research, compared to their non-computer science peers, made more ethical choices when faced dilemmas in computing profession. In terms of the provided solutions, computer science majors were more focused on technical aspects and within the lower levels of decision making while non-computer science students build their solutions around effective communications and from a higher level of decision making. It was harder for computer science majors to think that they have the power to convince others or make decisions that are beyond the tasks that are assigned to them.

One of the implication of this study is that computer science majors should be engaged more in activities that help them to build the confidence to interact effectively with their managers and peers to raise their concerns effectively when needed. Also, computer science students should be provided with cases that help them understand the importance of thinking outside the technical aspects when necessary.

Another important implementation is the importance of educating the college students about computing ethics and the dangers of unethical computing practices. The findings from non-computer science students showed not only their higher tendency to make unethical decisions for others, but also their own vulnerabilities due to the lack of knowledge on the seriousness of issues such as privacy.

Finally, many students from both groups were not confident to stand up and take action when it came to the jobs assigned to them. They simply rationalized the wrongdoing by attributing it to performing one's job. As participating computing science majors were able to make more ethical decisions in this regard, and some of them used the World War example to argue for the

unethicality of the situation, this can be another lesson to be implemented in other courses on ethics.

Future research should provide more insights about the reasons behind the differences between ethical decision making of computer science majors and other college students. Using other relevant ethical scenarios will help us understand other aspects of the ethical decision making and the ways we can improve the ethical development of college students. Other research can use the findings from this article to design qualitative studies to study whether or not the findings from this paper hold in different contexts. Such studies will help the generalizability of the findings of the current research to provide a better picture of decision making when facing ethical dilemmas in computing.

References

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Prentice-Hall, Inc.

Bandura, A. (1999). Moral disengagement in the perpetration of inhumanities. *Personality and social psychology review, 3*(3), 193-209.

Davis, M. (2002). Can professional ethics be taught? In M. Davis (Ed.), *Profession, code, and ethics* (pp. 231–246). Hants, England: Ashgate Publishing.

Foote, M. F., & Ruona, W. E. (2008). Institutionalizing ethics: A synthesis of frameworks and the implications for HRD. *Human Resource Development Review, 7*(3), 292-308.

Parks, S. D. (1993). Is it too late? Young adults and the formation of professional ethics. In T. R. Piper, M. C. Gentile, & S. D. Parks (Eds.), *Can ethics be taught?* (pp.13-72). Boston: Harvard Business School.

Rest, J. R. (1994). Background: Theory and research. In J. Rest & D. Narvaez (Eds.), *Moral development in the professions: Psychology and applied ethics* (pp. 1-26). Hillsdale, New Jersey: Lawrence Erlbaum Associates, Inc.

Wynd, W.R., & Mager, J. (1989). The business and society course: does it change student attitudes? Journal of Business Ethics, 8(6), 487-91.

McCabe, D. L., Dukerich, J. M., & Dutton, J. E. (1991). Context, values and moral dilemmas: Comparing the choices of business and law school students. *Journal of Business Ethics, 10*(12), 951-960.