Intentionally Educating for the Social Good in Computer Science

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ABSTRACT

As exemplified in the ACM Code of Ethics and Professional Conduct, the ethical responsibility of computing professionals obliges both guiding and aspirational behaviors. The guiding aspect of this responsibility includes ethical principles focused on avoiding harm and trustworthiness, while the aspirational aspect focuses on contributing to society and human well-begin. Ethical computing is often identified with the guiding principles. Though valued, they should not overshadow the aspirational aims of ethical computing. Towards this end, we advocate for a proactive pedagogy that promotes the aspirational aspects of computing for the social good throughout the computer science curriculum. This abstract presents our efforts in this direction.

CCS CONCEPTS

• **Social and professional topics** → **Computer science education**; *Model curricula*

KEYWORDS

Ethics, Social Computing, Educational Practices, Pedagogy

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1 INTRODUCTION

Within computer science education, there are two fundamental principles that guide ethical thinking with respect to the impact of computing on the common social good. The first principle characterizes ethical conduct that attempts to avoid any negative impact on society, while the second attempts to intentionally make a positive impact. Examples of these guiding principles are found in the curricular outcomes specified in CS'13 [1] and ABET [2] and the ethical codes of ACM [3] and IEEE-CS [4], which include principles such as, "avoiding harm", "legal responsibility", "being trustworthy", "contributing to society and human well-being", and "recognizing that all people are stakeholders in computing".

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Inherently, the deployment of software impacts society with a mixture of desired and undesired consequences. Despite this, there appears to be a common perspective that equates ethical behavior only with managing the negative impact of computing on society. Evidence for this perspective appears in the public press, e.g. [5], and the real-world case studies used in ethical computer science education, which focus on behaviors to be avoided, e.g. [6]. If we view the undesirable and desirable impacts of a computing application on society analogous to Maslow's hierarchy [7], this perspective arises since desirable impacts are attained in situations when the avoidance of undesirable consequences is also attained.

In ethical computer science education, however, it is unfortunate to allow the consideration of avoiding negative impacts on society to overshadow the desire to use computing to improve the common social good. Towards this end, we advocate for proactively educating computer science students to intentionally use computing to promote the social good. The remainder of this abstract summarizes our efforts towards goal.

2 EDUCATING FOR THE SOCIAL GOOD

As a computer science program within a Jesuit, values-based university, our computer science degree has included a course with ethical computing outcomes for over two decades. In 2014, we began transforming the ethical aspects of our curriculum from one that primarily focused on ethical computing conduct as avoiding negative impacts on society to one that primarily focuses on having students consider using their computer science education to intentionally change society to promote the common social good. This ongoing transformation includes changes in the curricular requirements of the program, in the outcomes of courses, in the faculty involved in developing course content, and in the pedagogy used to teach ethical thinking.

Each of these changes is motivated by insuring that students are exposed, throughout the curriculum, to examples demonstrating both the avoiding harm nature of computing's impact on society, and the aspirational desire to promote the common social good. In additional to using such examples, a pedagogy designed to encourage ethical thinking in support of the social good is used.

A key characteristic of this pedagogy is to require students to practice behaviors that intentionally support the social good. Such practice is often combined with practicing their Java programming skills. Consider, for example, user interface design, which can be localized for use with different natural languages or designed to support users with disabilities, as part of accessibility [8]. Such designs support social diversity and inclusiveness. In this context, we required students to extend the implementation of their user interfaces to support localization and accessibility. Students are also required to consider other human factor issues in their design.

As we've argued for the hierarchical nature of the guiding ethical principles, in which intentional promotion of the social good must also include avoiding negative impacts on society, we also require students to practice behaviors that would generally be considered as avoiding harm. For example, while students are not required to develop hashing/encryption schemes, they are required to utilize these where appropriate (e.g. implementing password protection).

Although we emphasize the impact of computing on the social good throughout the curriculum, we also require a senior-level *Ethical Leadership in Computer Science* course, with outcomes specifically focused on ethical thinking. Previously, we described how our pedagogical approach to ethics is used in this course. At that time, we defined "ethical thinking as the ability to identify all stakeholders that may be impacted by a computing solution, predict consequences, both positive and negative for such stakeholders, apply a system of ethics to analyze the above impact and consequences, and make ethically informed decisions based upon these factors" [9].

In the remainder of this abstract, we focus on how the pedagogical approach used in this course also encourages an additional focus on the common social good by teaching skills that support students in eventually becoming ethical leaders in computing. Such leadership requires, among other things, taking the initiative in promoting the common good within the computing discipline. As with other aspects of their computing education, we believe computing leadership is based on a skill set that must be practiced. Hence, we require students to practice such leadership skills, while still in school, with the hope that this "priming" effort will better enable them to take on leadership roles in the future.

Early in this course, students are presented with, and asked to, identify existing leaders in computer science. Subsequently, the students must describe the characteristics they believe that make these individuals leaders in computing. An emphasis is placed on characteristics that promote the social good. In a similar fashion, students are presented with, and asked to, identify existing world problems, with social implications, that require a computing solution. We then operationalize our pedagogical approach by requiring students to select an unsolved, socially-minded world problem for which a computing solution is required. The students are then required to defend why they selected this problem as an exemplar of promoting the common social good. Throughout the remainder of the course, students must develop a solution plan for this world-problem. In this way, they are required to take the leaderships for the solution to a social problem of their own choice. This selection promotes student engagement and requires them to develop an ethical approach to which there is no readily available known solution, as found in a predefined case study.

Various aspects of the course content provide an understanding of what it takes to accomplish a project of this type. For example, students are encouraged to consider what it takes to put together and lead a team to accomplish the solution to the problem. This includes identifying any expertise outside of the computing discipline that might be required to carry out their solution. As another example, students are encouraged to identify how they might partner with, versus compete against, other organizations that can contribute to their solution. By the course's end, students will have created a "blueprint" of a solution to a real-world problem that would improve the social good, with the hope that they could go forward with this plan in the future (i.e. they are not asked to implement this solution, in the sense of programming).

To help increase the course quality, a multi-disciplinary faculty was used to design, teach, and improve this course [10]. Specifically, faculty with expertise in ethical philosophy, psychology, the law, and computer science have contributed. Currently, six sections have been taught by two faculty over a two year period with a new section and faculty currently in progress.

Although we are still in the process of collecting statistically significant data on our effort, informally, we have noticed a positive trend in the types of projects selected by our students. Namely, as outcomes focused on intentionally promoting the social good were added earlier in the curriculum, an increase in the types of socially-minded projects selected by the students have also increased, which suggests that that such intentional focus on using computing to promote the social good, throughout the curriculum, is advisable. In general, student and faculty feedback concerning the social focus of the project has been very positive.

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