

ACM SIGCSE Special Project Report

Developing Ethics Modules for Core CS and DS Courses

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Project Summary

Since 1991, ACM/IEEE computing reports and curriculum guidelines have recognized that undergraduate students need an ethics and social issues component in their education [1]. The ImpactCS project was funded by NSF to provide for this outcome [2]. In its first report, the project formally defined a tenth content area based on ethics and social issues [3]. In 1999 the final report argued for integration of ethics content into core courses in the computer science curriculum rather than requiring ethics as a stand-alone course [4]. The project members created a collection of resources that included intellectual and pedagogical frameworks, along with implementation strategies and example curriculum [5,6]. They intended for their curriculum to be continually updated by active faculty members, but this has not comprehensively come to fruition.

Since the ImpactCS curriculum was defined, students, content delivery modes, and the field of computing itself have changed. Generation Z expects lessons that are quick, interactive, and may be in class or online [7]. With the proliferation of social media, big data, autonomous vehicles, AI, and predictive algorithms, ethical and social issues have expanded to include transparency, data model misuse or misinterpretation, data validity, privacy, accessibility and environmental issues [8,9].

With this change in atmosphere, there have certainly been efforts to increase integration of ethics into individual core courses. Skirpan et al. [10] describe a Human-Centered-Computing course where ethical thinking is stressed in every aspect of design. Davis and Walker [11] report on the inclusion of ethical content into a course available to non-majors in which social issues naturally arise as students consider computer literacy topics. Inclezan and Pradanos [12] included sustainability topics in their database course. Many more excellent examples could be listed.

When this Ethics Modules project was proposed, two professors and two students from Point Loma Nazarene University had begun working on an updated version of the model put forth by ImpactCS which featured the continuity of an early introduction, continued discussion, and integration of ethical topics with computer science courses. A few modules had been written and tested. The special project funds would allow for the expansion of the project, creating new modules, testing the modules, and finding ways to effectively disseminate the modules.

The goal was for the modules to be varied and self-contained, holding the students' interest and easy for a professor to use "off the shelf". Furthermore, they would be short so students could see several modules during a semester without taking too much time from an already dense curriculum. Ideally a department would adopt the entire curriculum, so students would see the material across four years and graduate having thought deeply about ethics in computing and data science and being able to articulate their thoughts to future employers and colleagues using established ethics frameworks.

Project Status and Results

The project is ongoing. As proposed, it was expanded to include modules for data science as well as computer science. The introduction portion of the curriculum was formalized to present 4 frameworks, 3 of which are those we found most often in ethics curriculum: virtue ethics, deontology, and utilitarianism. We also included an analogies-based framework since computing is still a relatively new discipline, and conclusions could be drawn by comparing an ethical situation in a more established discipline to that in computing.

Additionally, many modules were written for core courses in both computer and data sciences. These modules were tested in focus groups, presented in courses and presented at The Tapia Diversity in Computing conference (September 2019). They were described in the proceedings of the IEEE Frontiers in Education (October 2019) [13]. Our research students were slated to share preliminary results of the additional modules at SIGCSE 2020, before the conference was cancelled due to COVID.

During the summer of 2021, professors representing multiple institutions gathered at Calvin University in Grand Rapids, Michigan for a workshop led by Lori Carter and Catherine Crockett focused on how to further grow the project, and to make it easily accessible to others. The result was the website: <https://integratedethicslabs.org/>, where the modules are now referred to as labs, reflecting the fact that they should be used as an integral, interactive part of the course, rather than an activity separate from the main course.

There are currently 17 labs posted and available to all, with descriptions of others on the way. Furthermore, all student handouts are available as is a summary of how to use the curriculum. The labs posted reflect what was learned during the writing and testing supported by the SIGCSE Special Project funding. Some of the lessons learned and incorporated in the improved labs are enumerated below.

Student engagement and lab length

We found that students were extremely interested in the labs and wanted to talk about the ethical issues presented. Often students who didn't normally talk in class participated. Our original idea of labs that were only 20-30 minutes had to be revised to include some pre-lab homework. In most cases, the students found the homework to be interesting and enjoyable. The in-class part remained at 20-30 minutes.

Off the shelf labs – maybe not quite

Our original idea of providing a lab that required no preparation on the part of the professor was flawed. While we do our best to provide all the materials, the professor must spend a little time reading through them and taking ownership. The lab may need to be adjusted to better reflect course material or the personality of the professor or class. Sometimes handouts will need to be printed or posted.

It's tough to present interdisciplinary material

The ethics labs involve 2 disciplines (ethics and computer or data science). About the same time that we were working on our ethics labs, Harvard University made available its Embedded EthiCS curriculum. There are a lot of similarities between what we have done and what they have done with one huge difference. The modules created by Harvard were written by and presented to computer science students by advanced PhD students or fellows in the Philosophy department. The CACM article reporting on the pilot acknowledged that the philosophers felt inadequate in their knowledge of technology and the computer science professors felt inadequate in their knowledge of ethics [14].

Because many of the universities that we expect to serve don't even have access to graduate TAs from a philosophy department, we tried to present our ethics frameworks at the most basic level possible so that they were true to the ethics discipline, but understandable by both the professor and student population using them. Our labs are designed to be presented by the professor of the course. We believe that having the students understand that the professor is not the expert and the professors understanding that they are not expected to be experts leads to a more open discussion.

A professor should not be required to present an ethics lab, and we should expect that some will not.

For the labs to be effective, the professor presenting it should embrace the need. If the professor is not interested in the material, that lack of importance will be conveyed to the student. Therefore, we assume that students will experience a lab with different levels of previous knowledge. Some students will have seen many labs, and some not so many. Each lab, therefore, must include sufficient background material to support the current lab.

Most recently, in May of 2022, Lori and Catherine presented a 2-day workshop during the 2022 Association of Christians in the Mathematical Sciences (ACMS) conference held at Azusa Pacific University. At the workshop, faculty participants from several liberal arts and state schools heard the background and philosophy behind the labs, experienced the labs both as a participant and as a presenter, and created original labs of their own. Several of the participants are interested in contributing labs to the project.

Report on Spending

The requested funding was spent during 2019-2020. As expected, it was used to support our research assistants and provide incentives for students to attend the focus groups and provide feedback. The research students conducted background research, facilitated the focus groups, provided feedback on our content, and wrote some of their own content. They also applied to the SIGCSE student research contest and were so disappointed to miss the opportunity to present their work when the conference had to be cancelled.

Summary

The money provided by the Special Projects grant allowed us to move forward in the development of an integrated ethics labs curriculum that we believe could work in any university. Given the momentum gained from the grant we were able to make great progress in the last two years. We acquired understanding of what worked and what did not, created many more ethics labs, created a website in which to house those labs, and added to our team people from several universities who have used the labs and what to contribute to the effort going forward.

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