Integration of Community Outreach into the Teaching of Ethics and Legislation in Computing: An Experience Report

Samira Santos da Silva[1], **Sincler Peixoto de Meireles**[2]

[1] Instituto de Ciência, Tecnologia e Inovação (ICTIN)
Universidade Federal de Lavras (UFLA)
São Sebastião do Paraíso, MG – Brasil

[2]Instituto de Ciências Matemáticas e de Computação (ICMC)
Universidade de São Paulo (USP)
São Carlos, SP – Brasil

samirasilva@ufla.br, professorsincler@gmail.com

Abstract. *Ethics education is increasingly important in computing due to technology's societal impact. This paper reports a teaching experience in Ethics and Legislation in Computing at the Federal University of Lavras (UFLA), using a hybrid model combining traditional lectures with active service-learning. Students applied concepts through extension activities at a local school and online via Instagram, and selected topics used a flipped classroom approach. These methods promoted engagement, peer interaction, and autonomous learning. Results indicate that hybrid and service-learning strategies are effective for teaching ethics in computing, enhancing both conceptual understanding and students' ability to apply ethical principles in real-world scenarios.*

1. Introduction

Ethical concerns have existed since ancient times and can be traced back to Antiquity, when different civilizations began to reflect on norms of conduct, justice, and human behavior [Annas 1995]. More recently, ethics has been increasingly addressed and considered across different domains [Andersson et al. 2022, Morgan 2024, Paik 2025]. However, it has become particularly prominent in the field of computing, where the rapid development and widespread adoption of artificial intelligence have made ethical discussions even more critical [Khan et al. 2022]. This growing concern has led to the integration of ethics into academic curricula, making it a core component of many computing-related degree programs [Goetze 2023, Weichert et al. 2025]. The inclusion of ethics as a formal subject aims to educate professionals who are not only technically proficient but also well-prepared to address ethical, moral, and legal issues associated with the development and deployment of computational systems.

Despite the growing recognition of the importance of ethics as a formal subject in computing curricula, there are still many obstacles to overcome in its teaching [Goetze 2023]. Professors in the computing field who did not acquire formal ethics training during their own academic careers are often the ones teaching ethics-related courses in numerous universities. As a result, there is often a sense of insecurity among professors regarding the most appropriate approaches, methodologies, and pedagogical strategies for teaching and learning ethics effectively. Besides, the largely theoretical nature of

ethics courses often fails to engage many computing students, who tend to prefer practical, hands-on, and technically oriented content, further complicating the effective integration of ethical reflection into computing education.

More recently, extension activities have been formally curricularized in Brazil and are now required to be integrated into teaching activities, a process that has raised several challenges for higher education institutions and faculty members. The curricularization of extension was established through Resolution No. 7 of December 18, 2018, issued by the Higher Education Chamber of the National Education Council, in compliance with the National Education Plan (PNE) 2014–2024, which defined, under Goal 12, Strategy 7, that 10% of the total workload of undergraduate programs must be allocated to extension activities [Brasil 2018, Brasil 2014]. As reported in [Fontenele 2024], this regulation required teaching units and their respective degree programs to revise their pedagogical projects in order to implement extension as a curricular activity. Despite this normative framework, many instructors report uncertainty about how to effectively integrate extension into their courses, particularly due to the lack of prior training and methodological guidance on how to align extension activities with teaching objectives.

This paper reports on a teaching experience in the course Ethics and Legislation in Computing, offered to undergraduate students of Software Engineering at the Federal University of Lavras (UFLA). The course adopted extension activities as a strategy to promote student engagement and protagonism. Unlike the traditional lecture-based approach, in which the professor assumes a central role by delivering content in a structured and predominantly expository manner, the adopted approach followed a hybrid teaching model. Half of the course workload was devoted to traditional lectures aimed at the structured transmission of theoretical knowledge, while the remaining half was based on an active service-learning approach [Weintraub 2018], in which students studied course-related topics and applied this knowledge through extension activities carried out in a public school in the region, as well as online through Instagram, promoting the integration of academic learning with community engagement. In this way, it was possible to observe not only a change in students' attitudes when transitioning from a traditional, lecture-based approach to a more active learning approach, but also the effects that participation in extension activities can have on the teaching of a recently curricularized discipline that is nevertheless of vital importance for professionals in the technology field. Additionally, in this part, for some components of the subject, a flipped classroom strategy pedagogical method [Bishop and Verleger 2013] was employed, in which students studied the topics at home, prepared lessons, and led in-class discussions through their presentations, fostering active participation, peer learning, and deeper engagement with the course content.

The paper is organized as follows. Section 2 presents the related work. Section 3 describes the methodology adopted in this study. Section 4 discusses the results obtained and their implications. Finally, Section 5 presents the final considerations and outlines directions for future work.

2. Related Work

Prior research in computing education has extensively investigated approaches to teaching ethics, highlighting a wide range of pedagogical strategies, challenges, and observed effects. A recent systematic literature review of ethics instruction in higher education

computing found that over the past four decades a diverse set of teaching strategies has been employed, including standalone ethics courses, integrated modules within technical courses, discussions, case studies, and experiential learning activities; however, many studies also noted challenges in articulating clear conceptions of ethics and in assessing student learning outcomes effectively [Brown et al. 2024].

Within the Brazilian context, there are examples of experience reports that focus on ethics in computing. For instance, an experience of teaching Ethics in Computing during the emergency remote teaching period employed interactive tools such as Kahoot! and peer evaluation, reporting that such strategies contributed to significant and engaging learning outcomes for students [Aguiar 2023]. Proposals for ethics education in computing have also been discussed, detailing activities designed to promote critical thinking about ethical issues and draw connections between ethical reasoning and professional practice [da Silva et al. 2024]. Moreover, reflective essays and position pieces have been published that explore the challenges of forming ethical understanding in computing contexts, particularly in research involving human subjects [Bispo Jr et al. 2021].

These studies collectively indicate that ethics education in computing is an active area of research and practice, with a variety of pedagogical innovations and reported outcomes. Nevertheless, there remains a need for more detailed experience reports that combine active learning, service-learning, and community engagement in ethics instruction — especially in contexts where these strategies are integrated as part of a hybrid course model, as presented in this work.

3. Methodology

This section presents the teaching methodology employed in the Ethics and Legislation in Computing course, offered to Software Engineering students at the Federal University of Lavras (UFLA). We first provide an overview of the course, followed by a description of its two main components: Part 1, which employed a traditional lecture-based approach, and Part 2, which adopted an active learning approach.

3.1. The Ethics and Legislation in Computing Course

The Ethics and Legislation in Computing course at the Federal University of Lavras (UFLA) is a mandatory subject for Software Engineering students. The undergraduate program comprises ten semesters, and the course is offered in the seventh semester, with a workload of 34 hours of theoretical instruction and 34 hours dedicated to extension activities. The course was offered and attended in the second semester of 2025, with nine students enrolled. The topics to be covered according to the course syllabus are described in Table 1.

3.2. Part 1: Traditional Learning Approach

In the first half of the course workload, Topics 1–5 from Table 1 were addressed using a traditional teaching approach, based on expository lectures, complemented by 11 graded activities and a written exam. Since the traditional teaching approach was used in this part, the professor played a central role in leading the classes. Some activities were completed at home, while others were carried out in the classroom. A summary of these activities is

Table 1. Topics covered in the Ethics and Legislation in Computing course.

#	Topic
1	Fundamentals of ethics and morality in computing and artificial intelligence.
2	Social, environmental, and economic impacts of technology.
3	Privacy, data protection, and regulatory challenges in the digital age.
4	Copyright, open-source software, and intellectual property.
5	Regulation and legislation applied to computing: LGPD, Marco Civil da Internet, and international standards.
6	Ethics in development, algorithmic transparency, and AI bias.
7	Codes of conduct, professional responsibility, and digital governance.
8	Ethical and legal principles of the Internet and automated decision-making.
9	Basics of computer forensics and cybersecurity.
10	Legal and contractual aspects of IT services.
11	Internet regulation and legal challenges for digital businesses.
12	Consolidation of Labor Laws (CLT) and their application in the IT sector.
13	Legal guarantees of access to information and open data policies.
14	E-governments, transparency, and social accountability.

presented in Table 2. The complete list of activities, along with more information, can be accessed on GitHub[1].

The 11 activities combined accounted for a total of 20 points. The exam consisted of 10 questions, each contributing 4 points to the total of 40 points for this assessment, within the overall course grade of 100 points. It covered the five topics considered (Topics 1 to 5 in Table 1) for the first part of the course. Students had 1 hour and 40 minutes to complete the exam. Half of the questions were open-ended, requiring written responses, while the other half were closed-ended, such as multiple-choice or true/false questions.

3.3. Part 2: Active Learning Approach

In the second part of the course, Topics 6-14 in Table 1 were covered using an Active Learning approach [Michael 2006]. The active learning approach is a teaching approach in which students participate in activities that encourage them to reflect on ideas and their application [Michael 2006]. It involves regularly assessing one's own understanding and skills in a given discipline. Knowledge is gained through active participation, with students mentally—and often physically—engaged in gathering information, thinking critically, and solving problems.

This part of the course was structured in three phases: (1) creating educational posts for Instagram, (2) delivering educational talks to high school students, and (3) preparing content for in-class discussions. The first two phases followed a Service-based Learning approach [Weintraub 2018], while the third adopted a Flipped Classroom methodology [Bishop and Verleger 2013]. All activities in the second part of the course were carried out by students in groups of three, with the same groups maintained throughout.

At the end of all activities in Part 2, the students gave a brief 30-minute presen-

[1] https://github.com/samirasilva/teaching_ethics_computing

Table 2. Summary of the 11 course activities in Part 1.

Activity	Topic	Summarized Description
1	Social Media Ethics Analysis	Research a social media platform (WhatsApp, Instagram, Facebook, TikTok, or X) and summarize its privacy policies, data protection tools, and measures against fake news with practical examples.
2	Ethical Computing Reflection	After watching the Nosedive episode, Season 3, Episode 1 of Black Mirror, write a 1-page text reflecting on whether society is moving toward a similar scenario and how computing can be developed more ethically and humanely.
3	Ethical AI Pillars	Provide a practical example for each of the 5 pillars of ethical AI (Fairness, Explainability, Robustness, Transparency, and Data Privacy), illustrating a real or potential problem for each.
4	Technology Impact Analysis	Choose a current technology and analyze its social, economic, and environmental impacts, highlighting positives and negatives, then create a visual map and suggest policies to maximize benefits and reduce harms.
5	*The Social Dilemma* Movie Analysis	After watching The Social Dilemma movie, choose a theme (e.g., data privacy, algorithmic manipulation, social/psychological impacts, tech company responsibility, or regulations) and identify ethical issues from the film. Include real-life examples and propose possible technological, regulatory, or social solutions.
6	Personal vs Sensitive Data	Classify given information as "personal data" or "sensitive data" (e.g., name, CPF, address, race, religion, health data, biometrics, financial info, identifiable photos/videos).
7	Netshoes[2] Data Leak Analysis	Analyze the Netshoes Data Breach: Which data was involved? Who was harmed? Which law was violated? What could have been done to prevent it?
8	Data Protection Legislation	Prepare a 20-minute presentation on LGPD (Lei Geral de Proteção de Dados – Brazil), CCPA (California Consumer Privacy Act), or GDPR (General Data Protection Regulation). Include: historical context, reasons for the law, rights of data subjects, responsibilities of organizations, comparisons, and real-life examples.
9	Ethics in AI Systems (*Her* Movie)	After watching the movie Her, analyze and answer some questions about: 1) Privacy and personal data handling, 2) Autonomy and consent, 3) Ethics in human-machine relationships, 4) Legal responsibility in case of harm caused by AI.
10	Intellectual Property Review	Present your definitions of copyright, free software, and intellectual property before and after the class on these topics.
11	Open Source and Free Software Investigation	For a given list of software (e.g., Jami, Cryptomator, Kdenlive, Zettlr, etc.), indicate whether it is freeware, free software, or open source, and provide a brief justification for your classification.

tation in which they summarized the three topics worked on by each group in a single presentation. More importantly, they provided feedback to their peers and the professor

about their experience presenting on computing ethics at the school.

3.3.1. Service-Learning Approach

Service-learning combines a course's learning objectives with meaningful community service. Students engage in community projects and reflect on their experiences, connecting theory with practice [Weintraub 2018]. As [Britt 2012] states, "Conceptually, service-learning is a form of pedagogy that engages students in community service and regular guided reflection on the service in order to deepen learning and enrich communities". This approach is valuable because it allows students to contribute to their communities while fostering civic engagement.

In this part of the course, students of the course created an Instagram account to share not only content about computing ethics but also to showcase the extension activities carried out at the school.

Creation of Educational Instagram Posts. The topics for creating educational posts were chosen by the students themselves, based on what they believed would be most engaging for Instagram. The selected topics were:

- **Topic 7:** Codes of conduct, professional responsibility, and digital governance.
- **Topic 13:** Legal guarantees of access to information and open data policies.
- **Topic 14:** E-government, transparency, and social oversight.

Each group was assigned a topic through a random draw. It was decided that each group would create two Instagram posts on their assigned topic, which would be published at intervals to ensure spacing between posts. Before posting, the students first presented their posts to the class, allowing everyone to provide feedback on the content and presentation.

Presentations of Educational Content at the School. The content for the presentations was first prepared at home, then discussed and presented in class before being delivered at the school. Students received feedback from both the professor and their classmates on the content and presentation. The topics covered were:

- **Topic 6:** Fundamentals of ethics and morality in computing and artificial intelligence.
- **Topic 8:** Privacy, data protection, and regulatory challenges in the digital age.
- **Topic 9:** Copyright, open-source software, and intellectual property.

Each group was assigned a topic through a random draw. After their presentation, the students were asked to create an Instagram Reels summarizing their visit to the school.

3.3.2. Flipped Classroom Approach

According to [Bishop and Verleger 2013], the flipped classroom approach may be defined in a broader way as assigning reading or preparatory activities outside of class and using class time for discussion, problem-solving, and active learning. This pedagogical method

inverts the traditional structure of teaching: instead of receiving content passively during lectures, students first engage with the material on their own—through readings, videos, or other resources—and then use classroom sessions to clarify doubts, explore applications, and engage in collaborative learning. The flipped classroom allows students to engage with content at their own pace and promotes active learning, critical thinking, and better knowledge retention through discussion and practice [Prieto et al. 2021].

The flipped classroom approach was applied by having students prepare content at home, present it in class, and then engage in a discussion. The topics were:

- **Topic 10:** Regulation and legislation applied to computing: LGPD, Marco Civil da Internet, and international standards.
- **Topic 11:** Ethics in development, algorithmic transparency, and AI bias.
- **Topic 12:** Codes of conduct, professional responsibility, and digital governance.

Each group had 1 hour and 40 minutes for their presentation and subsequent discussion.

4. Results and Discussion

This section presents and discusses the results of teaching computing ethics to Software Engineering students through a hybrid learning model that combines traditional learning with active learning, primarily grounded in university extension activities. The results are presented for both parts of the methodology, followed by a discussion of their implications.

4.1. Traditional Learning Approach

During the first part of the course, which employed the traditional learning approach, it was noticeable that the expository lectures were not very engaging. Since Ethics and Legislation in Computing is a theoretical subject, students often became bored and were frequently distracted by their smartphones. The moments when students were most enthusiastic were during the 11 activities, as these allowed them to move from a passive role to a more active one. This was when they could take theoretical concepts from the course and apply them in practice. Their average score for the activities was 17.8 out of 20, ranging from a minimum of 13.8 to a maximum of 19 points. Additionally, a particularly successful component was the exhibition of the film *The Social Dilemma* and an episode of the series *The Mirror*. These were the moments in class that captured the students' attention the most.

Regarding the exam, the students performed well, even though their participation during the lectures was not very active. The class achieved an average exam score of 35.3 out of 40 points, with the lowest score being 31 and the highest being 39 points. The high scores were likely due to the fact that ethics is a subject that can be studied and understood independently, even if a student did not engage fully during the lectures. Unlike courses in exact sciences, where continuous practice and problem-solving are essential, in this case the exam score does not reflect the level of engagement with the course, which was observed to be very low due to the lack of participation during the lectures.

4.2. Active Learning Approach

In the second part of the course, the first assignment involved creating an Instagram profile where students could share educational posts on ethics and computing. The pro-

file is available at `https://www.instagram.com/eticadigital_ufla/` and is named "Ética Digital". All aspects related to the profile, including its name, logo, and color scheme, were discussed in class. The colors chosen were aligned with those used in the university's official logo to ensure consistency and a cohesive visual identity across all posts.

After creating the posts, students presented them in class, received feedback, and then gradually published the posts on Instagram over time. The posts could be either in carousel or Reels format, allowing for more information to be shared. The captions and hashtags for the posts were also agreed upon during class discussions. In total, for this activity, students created 5 carousel posts, which achieved an average reach of 1,445.8 views, ranging from 328 to 2,686, and 1 Reels post, with a reach of 961 views. Figure 1 illustrates the first image of the 5 carousel posts on ethics created by the students.

(a) Post 1 (b) Post 2 (c) Post 3

(d) Post 4 (e) Post 5

Figure 1. Educational posts on Ethics in Computing created by the students.

The next activity in this part of the course involved presenting educational content on ethics to students at the Clóvis Salgado State School in São Sebastião do Paraíso, MG. This school was chosen because the principal was very supportive of extension activities and the school regularly carries out projects in partnership with the university. The presentations were held over a period of three consecutive weeks, with one session per week, each lasting 1 hour, including time for questions. The sessions were delivered to

third-year students. Focusing on third-year students was also intended to motivate them, in the short term, to consider enrolling in the Software Engineering undergraduate course at the university.

The student presenters reported that the experience was very positive. The school students were highly engaged and showed strong interest in the topics. The presentations were made even more engaging because, at the end, the presenters included icebreaker activities such as interactive games, quizzes, and playful exercises, with small rewards like candies. After each session, students were asked to post a summary of their school visit on Instagram. These Reels achieved an average reach of 1,720.5 views, ranging from 494 to 3,117, demonstrating substantial engagement with their content. Additionally, the student presenters were asked to write a reflection on their experience at the school. Overall, these reflections highlighted how enriching the activity had been for them. One student even noted that the school students were highly motivated to pursue studies in computing and asked about the admission process to the university to which the presenters belong. Figure 2 depicts their presentations at the school.

Figure 2. Students presenting at the school.

Finally, the experience of assigning students specific topics and having them present to their classmates, followed by a discussion, was also very positive. The idea was to implement a kind of flipped classroom approach, even if only for a few topics, so that classroom roles could be reversed and students could take a more active role in their own learning. After each group's presentation, time was allocated for questions, which led to very interesting and relevant discussions. One particularly engaging moment occurred during the presentation of Topic 10, Legal and Contractual Aspects of IT Services, when students asked how issues related to the LGPD (General Data Protection Law) have been applied within contracts. The interaction among the student presenters, the professor, and the rest of the class was very fluid and productive.

At the end of the second part of the course, all students gave a short presentation summarizing their experiences in this more active part of the course and reflecting on what it was like to participate in these activities. During this session, they also had the opportunity to share their experiences from the school presentations with one another. The students' grades for this part of the course had an average of 35.83, with a minimum of 33.5 and a maximum of 37.5.

4.3. General Discussion

Overall, the experience of teaching the course Ethics and Legislation in Computing through a hybrid approach, including extension activities, was very positive.

The average final grade for the course was 88.7, with a minimum of 85.2 and a maximum of 95.1, which are very good results for a course that, due to its theoretical nature, may not be the preferred choice of students in a technical or exact sciences program. However, grades alone are not the main goal of a professor when teaching a course. The primary objective is to ensure that students have solidly absorbed the proposed content, and as observed through student engagement in the second part of the course, this goal was successfully achieved. Moreover, studies show [Duran 2017, Fiorella and Mayer 2013] that one of the most effective ways to learn is by teaching, which is precisely what the students were required to do during the second part of the course.

To quantitatively measure the effectiveness of the course, and taking into account not only students' grades, they were also asked to voluntarily and anonymously complete a short questionnaire to evaluate their experience. Eight out of nine students volunteered to respond to the questionnaire.

The first question and its results are shown in Figure 3. This question concerns the teaching formats that students consider most effective for learning ethics. Students were allowed to select more than one option. As shown, the majority (75%) believe that case studies and practical projects or simulations are the most effective methods for learning ethics.

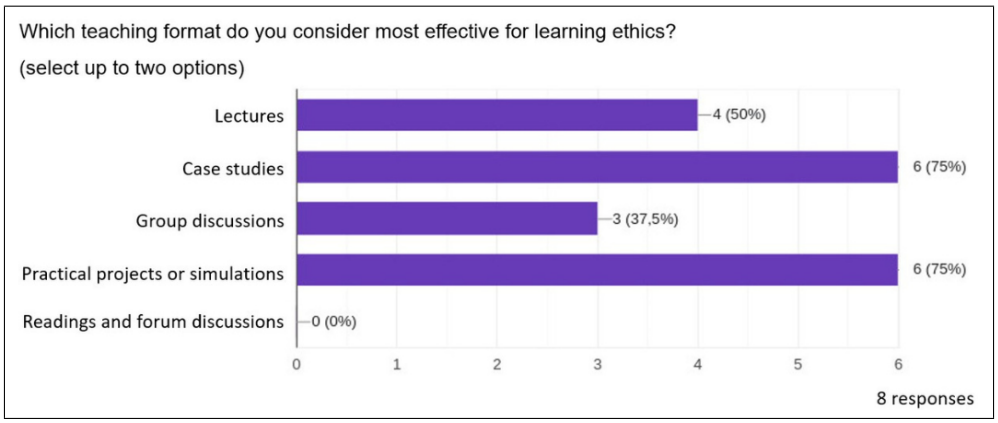

Figure 3. Question regarding the best teaching format to learn ethical concepts.

The second question and its results are presented in Figure 4. This question addressed the level of confidence students feel in applying ethical concepts in real-world work scenarios. The majority (87.5%) reported a confidence level of 4 or 5, representing the highest degrees of self-assurance.

Figure 4. Question regarding the level of confidence the students feel in applying ethical concepts.

Finally, the third question and its results are presented in Figure 5. This question addressed students' self-assessment of their understanding of ethics in computing at the time the questionnaire was administered, that is, by the end of the course. Most students (75%) reported a high or very high level of confidence in their comprehension, confirming the effectiveness of the hybrid teaching approach in fostering understanding and engagement in the subject of ethics in computing.

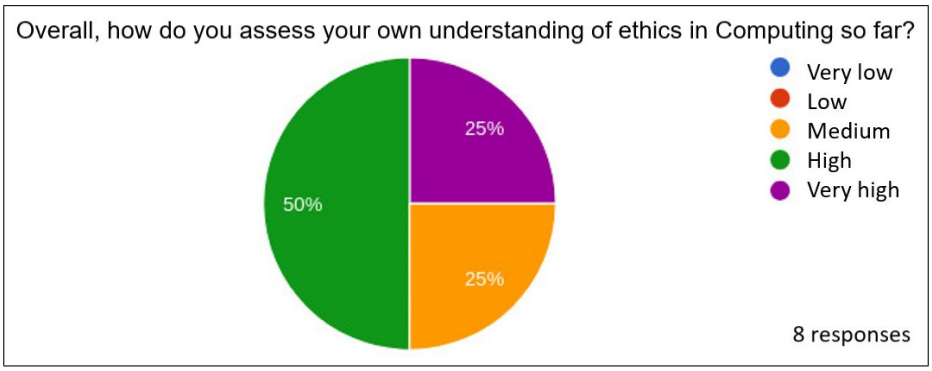

Figure 5. Question regarding the students' self-assessment of their understanding of ethics in computing.

4.4. Threats to Validity

This experience report presents some threats to validity that should be considered. Internal validity may be affected by participant bias, as students could have been more engaged due to observation or evaluation, and by the reliance on self-assessment questionnaires, which may not fully reflect actual learning. The small sample size and the fact that the service-learning activities were conducted with only one school also limit the generalizability of the findings. Construct validity may be threatened by varying interpretations of "engagement" or "learning effectiveness" and the use of indirect measures such as grades or self-reports. Additionally, causal conclusions should be made cautiously, as improvements in engagement and understanding may have been influenced by external factors such as individual motivation or peer interactions. Finally, operational factors, includ-

ing variations in the execution of activities and the short observation period, may have affected the observed outcomes and limit conclusions about long-term impact.

5. Final Considerations

This paper presented a teaching experience in the Ethics and Legislation in Computing course, which combined traditional lectures with active, service-learning and flipped classroom strategies. The hybrid approach allowed students to engage with theoretical content while applying their knowledge through community-based and online activities, fostering active participation, peer learning, and deeper engagement. The results indicate that integrating extension activities and active learning methods can positively influence students' attitudes, motivation, and understanding in a course that is both recently curricularized and essential for technology professionals.

One of the main conclusions of this work is that the inclusion of active learning approaches, particularly service-learning, was highly positive, leading to students who were more engaged and committed to the course. Students returned from the school activities excited and motivated. We believe that adopting a hybrid approach for this course was essential, as the first part of the discipline provided a solid theoretical foundation, which then enabled students to actively participate and autonomously explore new content in the second part.

Furthermore, we would like to emphasize the need to adopt teaching strategies beyond the traditional lecture-based approach in courses such as Ethics and Legislation, which are highly theoretical in nature. If taught exclusively through expository lectures, students may become bored, inattentive, and disengaged, ultimately hindering their learning and understanding of the course content.

For future work, it would be valuable to investigate the long-term impact of the hybrid teaching approach and service-learning activities on student engagement, learning outcomes, and interest in technology-related careers. Comparative studies between traditional and hybrid course models could provide quantitative evidence of the pedagogical benefits. Additionally, expanding service-learning projects to other schools, communities, or digital platforms would allow exploration of different contexts and audiences. The integration of educational technologies, such as collaborative platforms, online quizzes, or engagement dashboards, could further enhance interaction and assessment. Finally, evaluating the impact of these activities on the community beneficiaries and exploring the application of hybrid and flipped classroom approaches in other highly theoretical disciplines could provide broader insights into effective teaching strategies

The complete material produced in this work can be accessed at `https://github.com/samirasilva/teaching_ethics_computing`.

Ethical Issues and Artificial Intelligence Use

The Sociedade Brasileira de Computacao's (SBC) ethical requirements for educational and extension activities with minors were followed in this study. There were no academic or psychological hazards associated with the intervention, all data were anonymised, and participation was voluntary. ChatGPT was only utilized to assist with the manuscript's authoring and linguistic editing.

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