Amplifying Social Impacts of Computing Standards

Reference materials for standards writers

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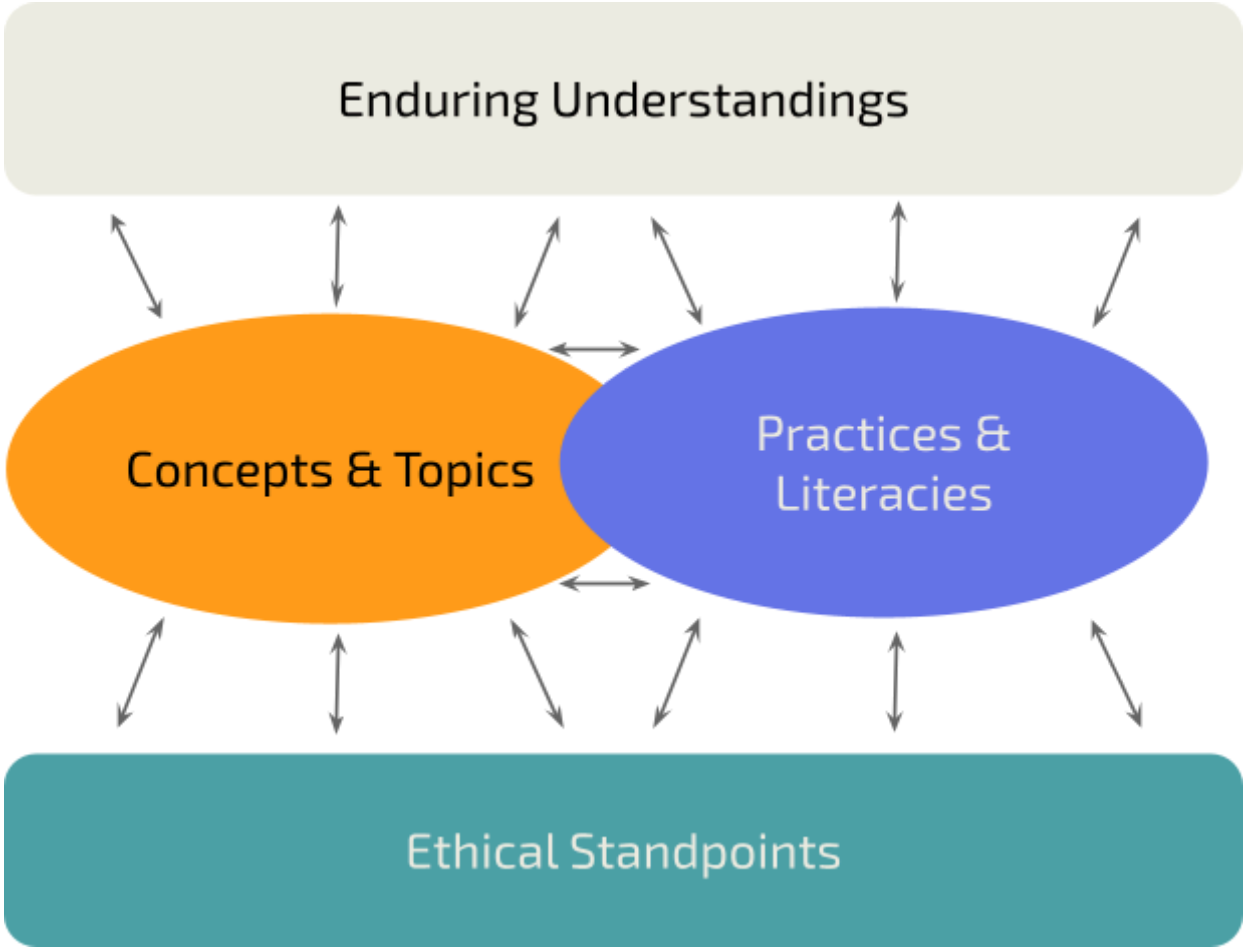
Mapping the "Learning Landscape"
of CS Ethics and Social Impacts



Enduring Understandings in CS Ethics and Social Impacts

Enduring Understandings around social impacts and ethics in computing are “first principles”, “a priori assumptions”, “foundational orientations” or “big ideas” related to **understanding** social impacts and ethics in computing.

Countering sociotechnical myths around…	**We understand that computational technologies…**
techno-naturalization	…are made by humans
techno-neutrality	…are not neutral …are value-laden …reflect biases and ideologies of their creators
techno-benignity	…are power-laden …can have unintended consequences that cause harm …can have *intended* consequences that cause harm
techno-solutionism	…have limitations, they cannot solve all problems
techno-determinism	…are unpredictable …are not inevitable, they can have the course of their development altered …impacts are not solely driven by the choices of their creators …impact society AND society impacts how their development plays out
techno-decontextualization	…are socially, culturally, historically, economically, and/or politically situated …“intersect and are intertwined with sociopolitical systems” (per Vakil and Higgs)

Topics and Concepts in CS Ethics and Social Impacts

Nature of Harm linked to computational technologies	**Mechanisms of harm** linked to computational technologies	**Design values** for computational technologies
What kinds of harm can computational technologies have on our world?	How do they cause those harms?	What values should they be designed towards to prevent those harms?
E.g. Racial discrimination in hiring practices → lack of professional and economic opportunity	*E.g. e.g. algorithmic bias, data bias, inappropriate automation of decision-making systems*	*e.g. fairness, accuracy, justice*

Nature of Harm linked to computational technologies

Privacy harms	Loss of privacy, violation of privacy
Discrimination	Race, Gender, Ability, Socioeconomic status, Nationality, Language, Religion, Sexuality
Harms linked to tech production	- Environmental harms (e.g. Carbon emissions, usage of scarce water resources, e-waste) - Health harms (e.g. associated w/resource extraction of rare minerals) - Exploitation of labor (within technology design/enactment) - Mental health impacts of content moderation
Health, well-being, mental health, or physical harms	- Health (e.g. algorithms denying care in health systems) - Mental health (e.g. online harassment or bullying due to lack of platform moderation) - Well-being (e.g. attention fragmentation or social comparison on social media) - Physical safety (e.g. doxxing or SWATing, algorithmically generated driving directions that aren't safe)
Political Harms	- Political interference/instability - Political polarization (e.g. "echo chambers") - Social fragmentation/erosion of trust - Political suppression (via surveillance) - Insecure voting systems
Economic harms	- Automation (as linked to job loss) - Discrimination (e.g. in hiring algorithms) - Intellectual property theft and/or lack of attribution (e.g. within Gen AI models) - Monetary theft (e.g. online scams) - Inaccessible social services (e.g. via hostile design of systems)
Cultural harms	- Erosion of social or cultural practices around creativity, communication, or other areas (e.g. declines in reading, AI replacing creative practices) - Linguistic and/or cultural hegemony
Educational harms	- Loss of student privacy - narrowing of pedagogies via edtech

Mechanisms of Harm linked to computational technologies

Underlying inputs, processes, practices or characteristics related to computational technologies that lead to harms. These can include:

- Unintended consequences or lack of accounting for negative externalities
- Design tradeoffs or dilemmas
- Algorithmic bias
- Data set bias
- Lack of data integrity
- Inaccuracy in high stakes technological systems (e.g. Theranos, British Postal Service scandal)
- Lack of content moderation
- Technologically mediated misinformation/disinformation
- Inappropriate automation of decision-making systems
- Vulnerability via centralization
- Vulnerability via lack of security (e.g. data breaches/thefts)
- Algorithmic opacity (e.g., see Black Boxing, ignorance, agnotology).
- “Dark Patterns” or hostile design (intentional design towards harmful outcomes)
- Behavioral “shaping” (a la Surveillance Capitalism per Shoshana Zuboff)
- Surveillance and tracking
- Data commodification (i.e. sale of data)
- Weaponization of technological neutrality
- Data extraction
- Colonization

Design Values for computational technologies

Design values for computational technologies are underlying principles related to ethical or responsible technological development. These are characteristics that might constitute what it means for a technology to be “ethical” or values-based. These can include:

Fair	Computational technologies that treat users equitably, in ways that challenge or reduce bias and discrimination
Accurate	Computational technologies whose outputs are consistent and aligned with intended outcomes
Transparent	Computational technologies, and creators, that are open and clear about how they function and their impact on the world
Explainable	Computational technologies that are able to provide producers and consumers with understanding about how decisions or outcomes are created
Accountable	Computational technologies that are designed or facilitated in a way that makes it possible for producers to be held accountable for social impacts that result from their production, use, or deployment
Trustworthy	Computational technologies that both producers and users perceive as reliable in terms of their uses and intended uses
Safe	Computational technologies that can be reliably used without causing harm to users and the environment
Accessible	Computational technologies that can be used by a wide variety of people, especially people with disabilities
Inclusive	Computational technologies designed to be used by culturally, socially, linguistically, and somatically diverse individuals and populations
Sustainable	Computational technologies designed to be environmentally or ecologically (build and grown) beneficial
Just	Computational technologies that support human values of fairness and flourishing, often in contrast to unjust conditions
Decentralized	Computational technologies that are structured in ways that are distributed for the purposes of supporting positive outcomes related to equity, justice, fairness, or other ethically-oriented benefits
Interoperable	Computational technologies with protocols or standards that allows data to move across platforms or systems

Social Practices in CS Ethics and Social Impacts

Examples in Concept and Classrooms

This handout shares some examples from the literature describing the kinds of practices/competencies/literacies that computer science students should know and understand. It provides a small window into what we learned when seeking to answer the following Literature Review Research Question: What does that literature define or suggest computer science students must learn (e.g., practices, competencies, and literacies) at the intersection of computing, ethics, and social impacts? Literature examples have been organized into six "practices" as follows:

1. Critical Inquiry
2. Critical Design
3. Critical Reimagining
4. Critical Advocacy
5. Critical Refusal
6. Responsible Use

Critical Inquiry examples in practice

Critical Inquiry defined as: "focus[ing] on understanding the underpinning of technologies and power structures" (Morales-Navarro & Kafai) and also "critical reading," "critical *on* computing," etc. Critical inquiry also include:

- Technological criticism
- Identifying underlying values embedded in computational technologies
    - Algorithmic auditing
    - "Evocative audits" (per Walker et al.)
    - Affordance analysis (per Lin)
- Investigating dominant and counter narratives in computing (per Kirdani-Ryan and Ko)
- Situating/analyzing technical concepts in social and historical contexts
- Situating/analyzing computational technologies within larger political economies

- comparing dominant computing approaches to design justice approaches (per Lin)
- "Red teaming"
- Understand how "garbage in, garbage out" works in practice

Examples:

1) Supporting Critical Data Literacy in K-9 Education: Three Principles for Enriching Pupils' Relationship to Data → (K-9)
    a) Co-design lessons/activities with elementary-middle school teachers focused on supporting students to do the following when thinking about social impacts and ethical issues of data/computing:
        i) Pupils making arguments which engage with the concrete context;
        ii) Pupils combining different representations to make sense;
        iii) Pupils emotionally engaging with and reflecting on the process and content of learning.
    b) Activities involve sharing personal data in a pop-quiz about "Who from Paradise Hotel are you?" and then exploring how personal data are collected and examined, followed by learning about K-nearest Neighbor (KNN) models through an unplugged activity that then leads to data modeling with computers;
    c) They also developed a "data compass" that is an x-y coordinate system in which the horizontal axis describes how willing pupils are to share data and the vertical axis describes how valuable they think it is to the receiver. Students can use this as a way to examine data and privacy issues, measuring how willing people are to share certain types of personal data
2) CyberCivics: A Novel Approach to Reaching K-12 Students with the Social Relevance of Computer Science → (9-12)
    a) Electronic voting system experience for AP Government students in high school
    b) Opportunity to explore the Python coding and examine how faulty algorithms can impact voting results
    c) "The first unit in our pilot class opened with a discussion aimed at developing a definition for CyberCivics. Throughout the discussion, the instructor made frequent references to recent headlines on a wide range of related topics and issues, including electronic voting, privacy of electronic data and transactions, and digital rights management, among others (see Table 1). The point of this discussion was to make students aware of the myriad ways in which computer science-related technologies impact their lives"
    d) "The class viewed and discussed the 2006 documentary film Hacking Democracy [1], which documents vulnerabilities in the electronic voting systems that count over 80% of the votes in US elections. This helped students to gain a better understanding of DRE voting machines as electronic devices that run potentially faulty computer software."

    e) Provided with Python coding (annotated) to see how yes and no ballots were counted, then could examine why it counted incorrectly to get at the challenges in computing design
3) "What Happens to the Raspado man in a Cash-free Society?": Teaching and Learning Socially Responsible Computing → (9-12th grade)
    a) The article describes high school students engaging in debate around living in a cash-free society after reading two articles about the topic: one describing the positives of technological tools that make cash/coins obsolete, and another describing why we shouldn't make society cash-free.
    b) Through the discussion process and the teacher's pedagogy focused on social responsibility with computing, students engage in critical inquiry about how technology gets built without consideration of different communities such as low-income communities, communities of color and immigrant communities, etc. Consideration is given to who sits at tech design tables, and why diverse perspectives like those of the 100% low-income Latine student body of the class are needed in computer science
4) Teaching the Societal Consequences of Computer Science: New Ideas for Increasing Student Involvement → (undergrad)
    a) Active reading, discussion, role-playing, and writing about current technologies (described in the news) and their potential ethical/societal impacts
    b) Opportunities to critically examine technologies and their challenges/impacts
    c) "We thus, in the spirit of Connolly [5], emphasize active learning, teaching students how to reason from decisions to social consequences by asking them to reason about possible consequences of technology in current news. This solves the engagement problem. Our students voluntarily read on-line technology literature; in the course we augment this reading with on-line material that places their reading in the context of present and future society. They engage naturally with topics like self-driving cars or bitcoin. The bootstrap we give them includes tools like critical reading and discussion, not to mention sources of information that discuss the societal implications of technology."

Critical Design examples in practice

Critical Design: (per Morales-Navarro & Kafai) - (also "critical writing", "critical *in* computing") - "Design promotes understanding criticality while making computing applications, creating a relevant context for learning technical skills and concepts"

- "Designing for social good"
- Empathy and perspective taking
- Designing w/ethics in mind
- Designing tools/practices to make transparent computationally-mediated harms
- "Tech-jamming" to resist computational harms (e.g. wearing masks at surveilled protests)
- Open source licensing
- Participatory design processes

Examples:

1) A Middle-School Module for Introducing Data-Mining, Big-Data, Ethics and Privacy Using RapidMiner and a Hollywood Theme → (6-9 grade; middle school)
    a) Students learn about decision trees and data mining as well as working with large datasets, then they go through a process of designing a decision tree to determine if people would watch certain movies, then compare that to the class vote. They create the predictive model with RapidMiner and discuss data privacy and security issues related to these data mining tools and predictive models
2) No User Left Behind: Including Accessibility in Student Projects and the Impact on CS Students' Attitudes → (undergrad CS/engineering)
    a) In an HCI course focused on "user interface" and "usability," students build a user interface to support the use of a non-mouse and (nearly) non-keyboard-based input for people who have limited ability to use a mouse or keyboard
    b) Students begin by constructing a set of specifications from the problem statement posed (that include written description of scenarios and functional requirements of the tool based on the user). Students engage in a case analysis, task analysis, and construct a prototype.
    c) Students apply learning about accessibility issues to how they design mouse and keyboard functions
3) Understanding "Dark" Design Roles in Computing Education → (undergraduate CS)
    a) Students assigned projects where they take on manipulative roles in the process of trying to fulfill a specific Alexa design plan
    b) "categorized as: 1) Solution-focused roles: *Puppeteer*, *Nagger*, and *Diluter*; and 2) Rationale-focused roles: *Justifier* and *Capitalist*. These pragmatic roles taken on by the participants allow further insight into computing students' ethical awareness, sense of responsibility, and potential future directions that could enhance pragmatic engagement in ethics in the context of computing education."

c) The team use these roles as a way into thinking about where intervention around ethics education is needed and can happen during design processes

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Critical Reimagining examples in practice

Critical reimagining: (per Morales-Navarro & Kafai)- (also "speculative practices", both analysis and production) - "reimagination centers on rethinking the present and the past to critically reimagine computing for the future".

Examples:

1) A Living Framework for Abolitionist Teaching in Computer Science
    a) This is more theoretical - describing key ideas to inform approaches to a just CS education that addresses ethics and social impacts…but there is a section that explores:
    b) Freedom dreaming and revolutionary spirit:
    c) "The act of freedom dreaming employs "radical imagination" [53, p. 100] and "liberatory fantasy" [27, p. 431] to envision and express what abolition—both the destruction of oppression and the growth of new life—might look like [53, p. 101-103]. In CS education spaces, freedom dreaming empowers CS students and teachers to reclaim agency over and reimagine the role of CS-produced knowledge and technology in society, while revolutionary spirit drives the effort to actualize that vision."
    d) "Jones and melo reimagine the CS learning space in their speculative fiction story as a multipurpose "thriving community centre" called the Ubuntu centre [42, p. 302-304]. Once an engineering school, the Ubuntu centre "has become a central resource for everyone in the community" [42, p. 303], partnering with community elders to run a Computing and Sustainability workshop at the local community garden, hosting an overnight shelter, organizing community meals, mutual aid, and technical resources, holding space for community dialogue, and paying reparations and land tax to local Black and Indigenous families. Jones and melo's vision proposes revolutionary and multidimensional change in CS education: the Ubuntu centre not only teaches life-sustaining knowledge, it offers life-giving benefits in the form of shelter and material resources to the entire community."

e) "Reflection Questions. *How might techno-nihilism or a lack of time and space to dream be holding me back from working toward change? How might my students and I synthesize the perspectives and oppressions discussed above to envision what freedom could look like? If freedom involves destroying an aspect of CS that I teach, research, or develop, how will I work to accept that? How might my students and I work toward realizing collective visions of freedom?*"

2) "Los Programadores Debieron Pensarse Como Dos Veces": Exploring the Intersections of Language, Power, and Technology with Bi/Multilingual Students → (middle school)
    a) While there was not an explicit reimagining activity described in this paper, one could "imagine" (pardon the pun) how students critique of digital tools and playful tinkering with language in those tools could build into an act of critical reimagining as a next step
    b) For example, how could Ivan's playfulness with "keloke" in Scratch, or Álvaro's reflection on the computer's voice and identity as historically and culturally rooted, toward making space for imagining technology that could do and be different?

Critical Advocacy examples in practice

Critical advocacy:

- In relation to state actors, towards regulation
- In relation to private actors, towards design changes
- In relation to cultural practices/actors, towards shifts in social norms, political supports, etc.

Examples:

1) Conceptualising critical data literacies for civil society organisations: agency, care, and social responsibility → not a specific grade band
    a) This piece explores the concept of "data literacy" in relation to more than just technical skills (such as quantitative analysis), but also agentic, contextual, critical, and social skills;

b) The piece notes that skills needed for data literacy for the general public and civic participation "develop within the material social contexts of civic cultures, and how they can progress in tandem with critical awareness about the power aspects of data, so they can become central tenets of data advocacy"
c) This is more a theoretical piece about how to define data literacy, less a description of what these activities could look like in practice, but the ultimate goal is for people to understand the power structures behind data (understanding ethics/social impacts) toward engaging in data analysis in ways that improve society and support advocacy efforts in communities

2) Returning the Data Gaze in Higher Education → (undergrad)
   a) "In this article, we explore how data are made accessible and amenable through the workings of leaning analytics as they perform, and are performed as, a sort of data gaze. The data gaze, therefore, becomes as a 'means for understanding how data intervene in the social and how data come to shape decisions, judgements, and outcomes' (Beer 2019, 10). Within this framing, we further define the data gaze as: the sense of being looked at/upon, with or without one's knowledge, for purposes often unknown to those as gazed-at and over which they may or may not have any control or say. In and through the workings of learning analytics, students and staff are gazed upon according to the criteria, assumptions, and intentions of the institutional gaze and myriad of data assemblages"
   b) Using this concept of "the data gaze," the article then explores the concept of "data activism" for professors/faculty/staff/students that "involves a 'politics of the quotidian, as it alters the everyday relationship between citizens and automatized data collection', and in so doing, aspires to bring the fundamental elements of agency and politics 'back into the data collection machine' (Milan and Gutiérrez 2015, 130). We suggest that such activism requires distributed agency – humans and nonhumans working together – and is part of a data justice agenda that includes not only activism, but as Taylor (2017) suggests, the political economy of datafication
   c) The article describe the *Our Data Bodies* project that produced *The Digital Defence Playbook* that tried to shift "who gets to define the problem" = a 'workbook of popular education activities focused on data, surveillance, and community safety' to work towards data justice by developing knowledge and tools (Lewis et al. 2018, 5). These activities are ways to return the data gaze: first becoming aware of the data landscape and then adjusting one's actions. Taken further, these starting points can extend to other forms of data activism that include compiling counter-data narratives and mobilizing data science to challenge 'unequal distribution of data and power' (D'Ignazio and Klein 2020, 2). The drive towards reflexivity and mobilization is crucial for activist work and acknowledges the importance of working on and through the larger data ecosystem."

Critical Refusal examples in practice

Critical refusal:

- Refusal to use specific computational technologies (i.e. boycotts)
- Refusal to design specific designs or types of computational technologies

Examples:

1) Taking play and tinkering seriously in AI education: cases from Drag vs AI teen workshops → (9-12)
    a) The paper describes "Drag vs. AI" workshops (the curriculum is available online at AJL's website) that were offered to teenagers in informal settings (library and queer resource center)
    b) The workshop involves: 1) a slideshow presentation about facial recognition technologies and ways to subvert them with drag makeup; 2) open-ended exploration of makeup, and 3) engaging with ServeFace facial recognition software
    c) Teens tinkered with ways to counter surveillance tools while reflecting on their impacts on society and daily life → they directly engage in "refusal" and "resistance" to potentially nefarious surveillance tools that may be used to track and lead to harm for minoritized communities, and especially queer communities (which will become even worse in the current political era)
2) The Heart of a Whistle-blower: A Corporate Decision-Making Game for Computer Ethics Classes → (undergrad)
    a) Students consider ethical issues in a "case study" setting of a company, using a deck of cards and enacting the case in a decision-making style game:
    b) ""In this game we will experiment with the pressures involved in group decision-making when the group has a hierarchical structure. As a group, the corporation must decide whether or not to take the action proposed in the case study. Your goal is to keep your job, influence the outcome of the decision-making process ... and perhaps blow the whistle if things don't turn out right!""
    c) In this game, students learn about the complexities of critical refusal in workplace contexts by acting out the situation where a boss may not want to act ethically, and where employees may follow in the boss's footsteps or choose to take action against unethical behaviors in a tech company context

Critical Use examples in practice

Critical Use:

Examples:

1) Empowering Digital Natives: InstaClone - A Novel Approach to Data Literacy Education in the Age of Social Media → (9-10th grade)
    a) This project/curriculum involves students engaging with InstaClone - a tool that mimics social media platforms in secure education environment so that students can generate data, process and visualize that data on analytics dashboards, and explore issues of ethics, privacy, and responsible use of social media
    b) The piece defines data literacy: "Data literacy entails the capacity to "select, clean, analyse, visualise, critique, and interpret data, as well as communicate stories derived from data and integrate data into design processes"" but notes that there is a "knowledge gap concerning the intermediate stages of the data life cycle and the long-term consequences associated with the digital footprint"
    c) This learning environment allows students to engage with social media posts, question whether they received any misinformation, reflect on "influencers" in the system, and then explore what data are getting saved and for what purpose, as well as whether this is ethical, and then analyze the behavior of three fictional users of InstaClone
2) The Case for LLM Workshops: The Responsible Use of Large Language Models by Faculty at Small Liberal Arts Universities → (university professors)
    a) This paper describes a workshop provided for university faculty, but these ideas could be applied to other contexts to learn about LLMs and how to use them responsibly.
    b) The workshops cover discussion topics: Artificial General Intelligence (AGI); Current state of and future LLM consciousness; LLM alignment; LLMs as challenging our self-understanding; The effect of biased training data; LLMs can be abused to create and disseminate misinformation; LLM cybersecurity threats and disinformation; Gated access to LLMs perpetuating social inequities; LLMs use of the original work of others in their training data;

Need for interdisciplinary expertise in the creation, training, use, education, and regulation of LLMs; Possible job and career evolution; Task outsourcing; LLMs and privacy.

c) Next the workshop covers how LLMs function
d) The workshop also involves encouraging students to ask the following questions when using LLMs:
    i) How did the LLM "contribute to my understanding of the topic?
    ii) What strategies did I employ to verify the accuracy and reliability of the AI-generated content?
    iii) How can I use AI tools responsibly and ethically to support my learning?
    iv) What challenges did I encounter while using [LLMs...] and how can I overcome them in the future?"

Ethical Standpoints related to CS Ethics and Social Impacts

Ethics at Scale

Socio-technical Ethics - Drawing from the field of Science and Technology Studies, which is the social, historical, cultural, and political study of science and technology, this standpoint is a type of meta-ethics, in that it provides a lens in which to view other ethical dilemmas about technology. It assumes that the social is always technical and the technical is always social when making moral choices about the interplay between technology and society. This means that technologies, in their design and use, are always value-laden and political.

Micro-Ethics - Ethical considerations that focus on decision-making and its immediate consequences at interpersonal levels that pertain to day-to-day interactions and needs.

Macro-Ethics - Ethical considerations that are about social and collective responsibility beyond individuals' immediate proximity.

Beyond Micro/Macro Dichotomy - There is always a degree of uncertainty in making choices about technology, and thus the outcomes of designing and using technology is partially unknown. In addition, democracy is about linking up individual action with social institutions for change beyond any individual's immediate environment (i.e., it makes linking the micro and macro a priority).

Ethical Standpoints

Consequentialism - A way of making choices based on evaluating **how actions lead to better or worse outcomes.** Utilitarianism

is a type of consequentialist standpoint that aims to maximize the most benefit to the most people.

Deontological - Making choices by appealing to a higher order (e.g., God, law, The Party) that determines universal rights and wrongs. The Kantian moral imperative is a type of deontological standpoint that assumes that there is a **universal right and a universal wrong** that pertains to everyone in every situation, no matter the outcome.

Virtue-ethics - Often grounded in the philosophy of Aristotle, this standpoint focuses on determining the right choice, behavior, and actions based on how it will support an individual's development of **moral character and virtues** (e.g., honesty, bravery, compassion, etc.)

Justice-centered - This standpoint centers making choices in relationship to questions about state and corporate **power and ideology**. It focuses on how actions and behaviors contribute to or challenge inequality, inequity, and hierarchy, often in the contexts of race, gender, sex, and disability marginalization, as well as the exploitation of the working-class and oppression of immigrants.

Pragmatism - Guided by human experiences and trial-and-error experimentations that are grounded in the sensibilities of fallibilism and iteration of the scientific method, this is a way of making choices where actions and behaviors are judged by how **useful they are for solving social problems** that are of concern to people's material circumstances. Pragmatists think that positive social change is possible but not inevitable and they reject perfectionism; in other words they are meliorists - a midway between optimism and pessimism.

Ethics of Care - Developed by feminist psychologists in response to the universalization of masculine morality, this standpoint emphasizes shared **interdependence and vulnerability** as motivations for judging how relationships should be developed to cultivate trust so that actors can appropriately respond to the needs of individuals and communities in ways that emphasize how health and wellbeing are relational and context-sensitive.

Indigenous Ethics - An overgeneralization of the diverse and diffused Indigenous communities' ways of being and knowing about themselves, other human and nonhuman persons and land, and in opposition to colonialism and coloniality. In the context of computer science education, this means recognizing how computing reinforces colonial relationships between persons and lands,

and judging behaviors and actions as better or worse based on how they help decolonize relationships and land through emphasizing **reciprocity and indigenous sovereignty**.

Existentialist Ethics - A standpoint that frames **humans as the creators of moral authority and meaning**, it emphasizes the importance of responsibility for the fact that humans are free to make their own individual choices. It prioritizes choosing actions and behaviors that support and respect other people's freedom. Freedom is often seen as a necessary burden, as it necessitates facing and accepting the consequences of one's actions and behaviors, especially when considering questions about infringing on other people.

Communitarian Ethics - A standpoint that is about making choices based on the responsibilities an individual has to the community or communities they are part of, help to create, and create them. It often focuses on considering how one is part of the community of people who must rely on each other for support through **bonds of solidarity and collective action (i.e., mutual aid)**, favoring cooperative volunteerism over top-down authority.

Egoist Ethics - A standpoint that is about making choices that **maximize the wellbeing and self-interests of the moral actor**. It assumes that if everyone acts in their own self-interest and prioritizes their own selfish wants and needs above others that correct ethical outcomes will follow.

Heatmap Statements related to CS Ethics and Social Impacts

The following statements can be used to support deliberation around what should be prioritized in learning CS ethics and social impacts.

When it comes to the focus of CS ethics and social impacts education in K12 schools, which is more important? K12 students should...
Big, Crosscutting
understand, analyze, critique, and reimagine the technologies that shape everyday lives
understand what kinds of harms can be caused by computing technologies, how they come about, and what they can do about them
consider their personal responsibilities, power, and privilege as creators of future technologies that can have a profound impact on society
recognize their own responsibility to stand up to exclusion, prejudice, and injustice when designing, engineering, and selecting software
practice sociotechnical humility, vulnerability, and curiosity
Enduring Understandings
understand that computing technologies are made by humans
understand that computing technologies are not neutral, they reflect biases and ideologies of their creators
understand that computing technologies are value-laden, they always reflect a perspective on how the world should work
understand that computing technologies have limitations, they cannot solve all problems (i.e. be wary of “Technosolutionism”)
understand what problems computing technologies can help solve, and what problems they can't
understand that people can create and use computing technology in ways that unethically exert power over others
understand that computing technologies can have unintended consequences that cause harm
understand that computing technologies can have intended consequences that cause harm

understand that computing technologies' impacts are not solely driven by choices of their creators, they're also shaped by broader forces
understand that computing technologies are not inevitable, it's possible to alter or limit the course of technologies' development
understand that social and historical context influences the development and use of technology, which can lead to unpredictable results
understand that computing technologies are socially, culturally, historically, economically, and politically situated
understand that computing technologies intersect and are intertwined with sociopolitical systems
understand that power relations are central in all social interactions impacting technology development and use
Design Values x Practices
be able to explain basic principles like fairness, safety, accessibility, accuracy, and inclusivity as they relate to technology development
deliberate about what kinds of values computing technologies should promote (e.g. safety, security, sustainability, fairness, justice, etc.)
learn how to design computing technologies that protect peoples' privacy and create confidentiality
learn how to design computing technologies that actively promote just outcomes and take into account historical wrongs
learn how to design computing technologies that promote trust
learn to design technologies that have low barriers to access so that no one is excluded from participation (e.g. the disabled or elderly)
learn to design computing technologies that minimize energy usage and environmental harm, actively centering values of sustainability
create algorithms and data processing procedures that are transparent, open, and accessible to ensure verifiability and traceability
understand the social benefits of computing technologies that center principles of interoperability and decentralization
understand the importance of transparency and accountability as they relate to computational technologies and their creators
understand the importance of explainability when it comes to AI and other computing technologies
ensure users of their creations have autonomy and freedom so that the responsibilities for decisions remain with technology users
be familiar with how failures around security, safety, and accuracy in computing have resulted in harms to people and communities
Nature of Harm x Practices
not have to deeply understand every possible harm that tech might have, but have a good sense of the range of possible harms
examine power imbalances in the design of computing systems that create, amplify, and reinforce inequities and injustices in society
anticipate social impacts of a technology in different environments and how it may enhance, degrade, or have no impact on quality of life

be able to describe positive + negative ways computing technologies impact people, and groups of people, especially marginalized groups
evaluate a technology's impact on different groups of people (e.g., BIPOC, women, LGBTQ+) concerning equity and diversity
evaluate a technology's impact on different groups of people (e.g., the elderly or disabled people) concerning accessibility and inclusion
understand potential impacts of computing on political life (e.g. mis/disinformation, suppression via surveillance, polarization, etc.)
be able to describe potential impacts of computing on the economy and workplaces (e.g. automation, gig work, workplace surveillance, etc.)
understand the past, present, and future of automation and its historical, current, and possible impacts on society
understand ethical issues associated with social media platforms, such as content moderation, mis/disinformation, and echo chambers
explore the limits of artificial intelligence with respect to decision making, bias, and moral reasoning
analyze ethical issues in artificial intelligence related to its use, such as plagiarism or degradation of creativity
analyze ethical issues in artificial intelligence related its development, such as unauthorized usage of intellectual property
analyze ethical issues in artificial intelligence related its development, such as increases in carbon emissions and global warming
be able to describe positive + negative ways computing technologies impact the natural environment (e.g. e-waste, carbon emissions)
understand the ways indigenous people and land have been negatively impacted in the creation of computing tools
understand the role of colonization in computing (e.g. using tech to exert power over the global south, data extraction and theft, etc.)
Mechanisms of Harm x Practices
learn about well known critical tech issues (e.g. algorithmic bias) AND obscure but impactful ones (e.g. inappropriate uses of automation)
understand the basic principle of "garbage in, garbage out" when it comes to bias and discrimination in data and algorithms
be able to recognize sources of algorithmic bias
"get under the hood" of biased data-sets in order to understand how they can lead to discriminatory results
better understand "dark patterns" by engaging in hypothetical design processes that prioritize profits over ethics
understand ethical issues related to making data into a commodity, including efforts to surveil and shape user behaviors
understand how and where data were collected to consider whether or not they should be used for certain purposes

Identify which kinds of algorithms need more or less human oversight or regulation (e.g. streaming recommendations vs self-driving cars)
Identify which kinds of social processes are appropriate to automate vs not (e.g. smart thermostats vs resumé screening)
engage in mock design processes that help them better understand the incentives engineers face that can lead to user harms
understand ways that over-centralization of technology systems can make them vulnerable to bad faith actors
understand how the idea of “technological neutrality” can be weaponized by bad faith actors (“It's just math!”)
understand how algorithmic opacity (i.e. “black boxes”) can lead to negative outcomes
Practices
identify assumptions, values, and moral dimensions embedded in computing systems or technologies
not only understand, but also question and problematize the ways data are generated, analyzed and used
systematically examine software for bias, exclusion, and injustice, identifying ways to redesign it or deter its use in particular contexts
understand and be able to use tech development approaches that put ethics at the center, such as values-based design
collaborate with marginalized stakeholders when designing and creating a software
identify and fix design flaws in computational artifacts that lead to social harms
understand methods to ensure the ethical data systems (e.g., anonymization, openness, transparency, explainability, avoiding biases)
design programs that automate decisions on data, while accounting for the effects of automation on broader issues of equity and justice
consider “value tradeoffs” in designing computing technologies - how optimizing for one value might make it harder to achieve another
be able to rethink the present and the past to critically reimagine computing and technology and create more equitable and just futures
engage in speculative practices to envision how technology could be reconfigured to proactively benefit their communities
be empowered to reimagine what can be done with computing and what computing can be, questioning and rethink the disciplines' assumptions
debate laws, regulations, and policies that impact the development, use, and impacts of computing in society
learn about specific approaches to holding technology creators and companies accountable, including social, legal, and technological means
understand various ways to “push back” on the way a technology or platform works, like boycotts or advocating for regulations

plan and carry out collective action against data and algorithmic bias and injustice and evaluate what strategies are most effective
be able to ask and answer the question: “should this technology even be created in the first place?”
be able to recognize when it would be appropriate to act as a whistleblower in the context of tech development
be able to recognize when it would be appropriate to refuse to participate in the development of a technology
be able to reflect on and decide when they want to stop using a computing technology because of negative impacts its having in their life
be able to reflect on and decide when they want to stop using a computing technology because of its negative impacts in the world
consider how their personal use of computing technologies could lead to harm (e.g. sharing misinformation, revealing private data, etc.)
learn to actively care the tech devices in their lives in ways that take into account environmental harms associated with over-consumption
be able to make informed decisions about how and whether to use technologies that use their personal data
Ethical Standpoints
identify and evaluate multiple ethical standpoints
analyze ethically relevant topics and examples from computer and data science using known ethical positions
analyze and critically reflect on well-known ethical dilemmas and cases (e.g., trolley problem, lifeboats on the Titanic, etc.)
be able to analyse and produce ethical arguments related to computational technologies
reflect on their personal moral and ethical attitude and its impact on their behavior and actions
be familiar with their own ethical values, those of the computing profession, their society, and various value systems that exist globally
be able to discuss and understand how some “easy” ethical approaches are questionable
question how choices align with the development of their moral character (e.g., being honest and compassionate)
identify ways computer science can reproduce and reinforce state and corporate hierarchies
understand that values and morals are created by humans
know that solving problems with computing technologies can create more problems
know that the social is always technical, and the technical always social
understand that moral authority resides in people

know that taking responsibility for the technologies they create and design is required for a free and open society
understand the importance of experimentation for figuring out democratic ways of living
know that designing and maintaining computing systems puts them in a role where they are responsible for other people
understand consider the interplay between the social and technical aspects of life when making moral choices
know that computing technologies can contribute to the vulnerability of marginalized populations
should focus on cultivating hope about a better future more than knowing about the discipline of computer science
work to create democratic cultures that inform how computing technologies and systems are designed and used
understand how respect for land includes attending to the environmental hazards that come from computing infrastructure
understand how the communities they interact with shape their moral choices and political judgements
understand that computing makes people interdependent
understand why Indigenous communities need sovereignty over their own data
understand that social change is possible, but not inevitable
discuss how ethical considerations in CS must recognize the uncertain or ambiguous ways that emerging technology shapes behavior and society

Critically Conscious CS Standards

From:

Amy J. Ko, Anne Beitlers, Brett Wortzman, Matt Davidson, Alannah Oleson, Mara Kirdani-Ryan, Stefania Druga, Jayne Everson (2025). Critically Conscious Computing: Methods for Secondary Education.

To see the full list of "critically conscious standards", which includes sections for algorithms and programming, data and analysis, and computing systems, visit:
criticallyconsciouscomputing.org/standards

	Original CSTA Standard	***Critically Conscious Revision***	**Chapters**
Impacts of Computing			
2-IC-20	Compare tradeoffs associated with computing technologies that affect people's everyday activities and career options.	*Examine power imbalances in the design of computing systems that create, amplify, and reinforce inequities and injustices in society.*	CS and Design, CS, Equity, and Justice, Encoding Intelligence, Operating Systems, Control Structures, Data Structures, Algorithms, Abstractions, Artificial Intelligence, Verification
2-IC-21	Discuss issues of bias and accessibility in the design of existing technologies.	*Explain how software excludes groups marginalized by their gender, race, ethnicity, language, and ability.*	CS and Design, CS, Equity, and Justice, Computers, Data Structures, Algorithms, Artificial Intelligence, Programming

2-IC-22	Collaborate with many contributors through strategies such as crowdsourcing or surveys when creating a computational artifact.	*Collaborate with marginalized stakeholders when designing and creating a software.*	Data Structures, Projects
2-IC-23	Describe tradeoffs between allowing information to be public and keeping information private and secure.	*Describe individual and collective tradeoffs of surveillance capitalism.*	Encoding Information, Operating Systems, Artificial Intelligence
3A-IC-24	Evaluate the ways computing impacts personal, ethical, social, economic, and cultural practices.	*Critique how computing amplifies, centralizes, privatizes, and automates social processes in society, impacting individuals, communities, and culture.*	CS, Equity, and Justice, Encoding Intelligence, Computers, Operating Systems, Control Structures, Data Structures, Algorithms, Abstractions
3A-IC-25	Test and refine computational artifacts to reduce bias and equity deficits.	*Systematically examine software for bias, exclusion, inequity, and injustice, identifying ways to redesign it or deter its use in particular contexts.*	CS, Equity, and Justice, Programming Languages, Data Structures, Artificial Intelligence, Programming, Verification, Tools, Projects
3A-IC-26	Demonstrate ways a given algorithm applies to problems across disciplines	*Demonstrate ways a given algorithm impacts different groups, communities, and disciplines in unequal ways.*	Control Structures, Algorithms, Abstractions, Artificial Intelligence, Programming
3A-IC-27	Use tools and methods for collaboration on a project to increase connectivity of people in different cultures and career fields.	*Use collaboration tools and methods to engage diverse teams in community-based projects.*	CS, Equity, and Justice, Verification, Tools, Projects
3A-IC-28	Explain the beneficial and harmful effects that intellectual property laws can have on innovation.	*Explain who intellectual property laws protect and who they harm.*	CS, Equity, and Justice

3A-IC-29	Explain the privacy concerns related to the collection and generation of data through automated processes that may not be evident to users.	*Explain how organizations use software to surveil users in order to leverage their activity data for profit and power.*	Encoding Information, Operating Systems, Data Structures, Artificial Intelligence
3A-IC-30	Evaluate the social and economic implications of privacy in the context of safety, law, or ethics.	*Evaluate the interaction between privacy, computing, and power.*	Encoding Information, Operating Systems, Artificial Intelligence
3B-IC-25	Evaluate computational artifacts to maximize their beneficial effects and minimize harmful effects on society.	*Critique the design, engineering, and use of software in society in relation to the matrix of oppression.*	CS, Equity, and Justice, Control Structures, Data Structures, Algorithms
3B-IC-26	Evaluate the impact of equity, access, and influence on the distribution of computing resources in a global society.	*Examine inequities in access to computing devices and the internet and how those inequities amplify other forms of oppression.*	CS, Equity, and Justice, Verification, Computers
3B-IC-27	Predict how computational innovations that have revolutionized aspects of our culture might evolve.	*Predict how computational innovations will shape culture, power, and equity in global society.*	Encoding Intelligence, Computers, Operating Systems, Control Structures, Abstractions, Tools, Projects
3B-IC-28	Debate laws and regulations that impact the development and use of software.	*Debate laws, regulations, and policies that impact the development, use, and impacts of software on marginalized groups.*	CS, Equity, and Justice, Computers, Abstractions, Artificial Intelligence