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Beyond the Algorithm: Empowering AI Practitioners through Liberal Education

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In the past year, Victoria has concentrated on Responsible AI, acting as a thought partner within the AI ecosystem. She was selected to attend Mila Quebec Artificial Intelligence Institute's inaugural global Summer School in Responsible AI, and invited to be an ambassador for Women in AI at the 2024 World Summit in AI. Victoria leads dialogues on digitization, ethics, employee upskilling, AI adoption, and public policy on emerging technologies. She designs workshops to bridge the digital divide and promote public education. She is a current Aula Fellow for AI Science, Technology, and Policy. She advises on digital governance, democracy, and inclusive city building for Democracy XChange, Canadian Vote Summit, The Canadian Internet Registration Authority's Internet Governance conference, and Maple Leaf Sports Foundation's Community Granting Circle, among others. A proud Humanities graduate, Victoria holds an HBA and MA in English Literature from the University of Toronto.

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Solenne Savoia has been immersed in the intersection of technology and SDG's for over six years. Deeply interested in the impact of technology on our societies, she designed and launched the first French summit dedicated to inclusive and sustainable tech back in 2018. Since then, she has launched numerous programs aimed at fostering inclusivity in the tech industry, especially for underrepresented groups with a focus on initiatives empowering women in tech. Transitioning from collaborating with impact-driven entrepreneurs, Solenne joined Mila in January 2023, where she now manages a portfolio of talent and learning programs in the ever-evolving landscape of responsible artificial intelligence. Those programs cater to a diverse audience, including machine learning researchers, industry practitioners, and policymakers, ensuring they build the necessary capacity to navigate and shape a socially beneficial AI landscape. Solenne Savoia holds a degree in English, American and French law, as well as a Master of Science in business management.

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Beyond the Algorithm: Empowering AI practitioners through liberal education

Abstract

As AI technology continues to transform society, there is a growing need for engineers and technologists to develop interdisciplinary skills to address complex, society-wide problems. However, there is a gap in understanding how to effectively design and deliver inter-disciplinary education programs for AI-related training. This paper addresses this gap by reporting on a successful summer school program that brought together specialists from around the world to engage in deliberations on responsible AI, as part of a Summer School in Responsible AI led by Mila - Quebec Artificial Intelligence Institute. Through deep dive auto-ethnographic reflections from five individuals, who were either organizers or participants, augmented with end-of-program feedback, we provide a rich description of the program's planning, activities, and impact. Specifically, our study draws from engineering education research, bridging the gap between research and practice to answer three research questions related to the program: (1) How did the program design enable a more effective understanding of interdisciplinary problem-sets? (2) How did participants experience the interdisciplinary work of the program? (3) Did the program affect participants' impact on interdisciplinary problem-sets after the program? Our findings highlight the benefits of interdisciplinary, holistic, and hands-on approaches to AI education and provide insights for fellow engineering education researchers on how to design effective programs in this field.

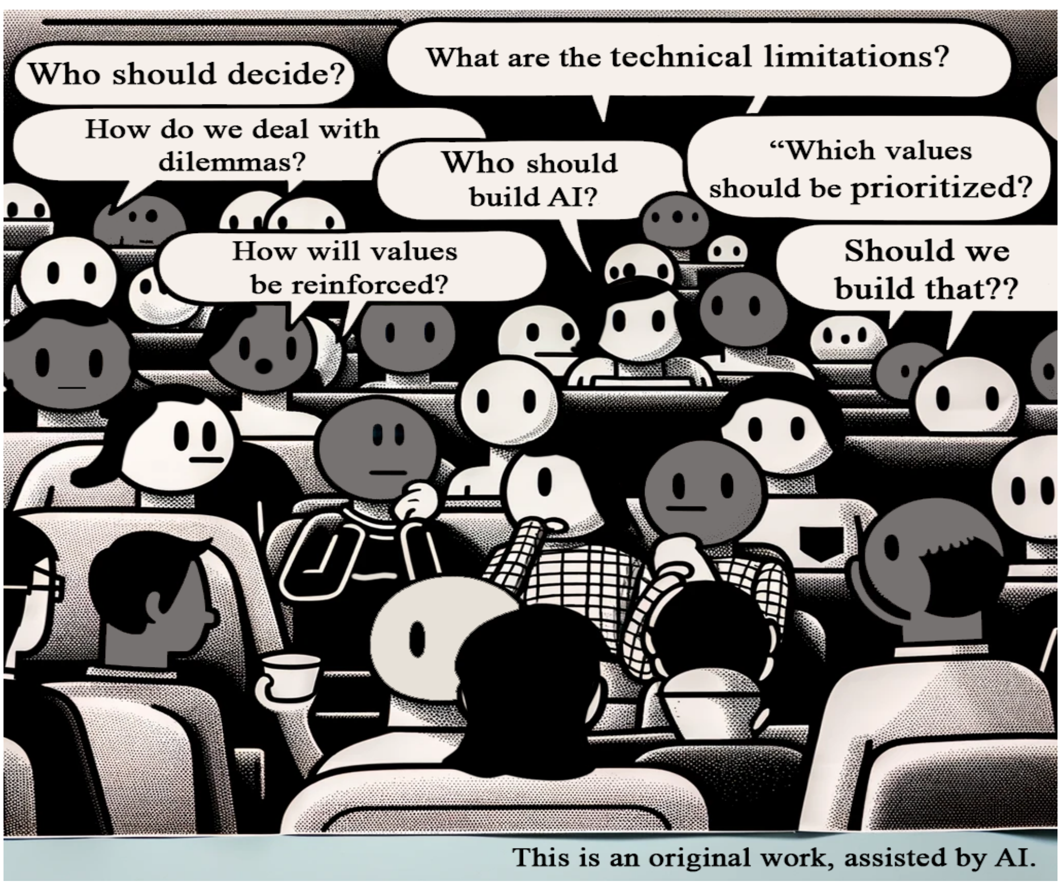

Figure 1: A cartoon depiction of an interdisciplinary conversation on responsible AI

Introduction

For decades, engineering educators have raised concerns about the need to embrace humanist and liberal arts education in the engineering curriculum. Researchers have called for integration between technical and humanistic content [1], [2], [3] as a path towards achieving "humanistic engineers" who can engage in socio-humanistic critiques: "Instead of—or alongside—traditional socio-humanistic coursework, we propose to integrate the humanities with technical and scientific knowledge so that the deeper issues that characterize the separations between, and the common ties linking, the 'two cultures'" [3, pp. 3]. These approaches highlight the role of humanistic and liberal arts education in engineering education in developing creativity, capacity for insight, originality, and a holistic view of challenges posed by technology.

Artificial Intelligence (AI) systems are becoming the "new norm in several industries" [4, para. 2]. This creates a need to integrate humanistic approaches in engineering education in fields participating in the development of AI systems. As Dignum reminds us, "the impact and consequences of an AI system reach further than the technical system itself, and as such, the system should be seen as a sociotechnical system" [5]. From the sociotechnical character of AI systems emerges the need to understand them holistically, in dialogue with societal systems. The pace of development of these technologies and the ethical challenges that come with them are also generating a need for new learning goals [4].When geared toward engineers, education about AI has the potential to connect practicing professionals to the collective and mutually dependent fields related to AI. Educating problem-solvers to exchange inspiration and insight in collaborative conversations in society is also a crucial training for what they need to accomplish in their work [6]. When engineers collaborate to understand the contexts that only society can provide, technical solutions gain potential impact. Van den Beemt et al. observed: "one of the important roles for interdisciplinary education efforts is to help students develop the kind of flexible adaptive expertise that will prepare them to solve a range of complex problems and work with scientists trained from a variety of perspectives as is increasingly becoming the case in cutting-edge research fields" [7].

Collaboration deepens an engineer's understanding of what's needed and the effects of a technological solution once it's deployed, especially as they relate to complex challenges, coined wicked problems [8] of our times, such as climate change [9]. Collaboration enables us to make tools with a better fit-to-purpose. Interaction among a diversity of people can contribute pertinent information towards impactful systemic progress. However, though "interdisciplinarity seems highly desirable in course design, especially problem or project design there remains a lack of investigation into how to facilitate this process or what kinds of features problems or projects need for interdisciplinary learning goals to be reached" [7].

This paper hopes to address this gap by contributing an example of a successful interdisciplinary education program for engineers in a mixed cohort of other specialists. Our area of interest is in the pedagogical, programming, and management methods from the humanities and social sciences that can support engineering education for society-wide problems, in particular as they relate to AI-related training for practicing technologists.

The experiences reviewed in this paper account for the mechanisms and benefits of undertaking interdisciplinary, holistic, hands-on approaches to AI education. To understand best practices and inform fellow engineering education researchers on how interdisciplinary program design in the field of AI may differ from other multidisciplinary fields, we report on an autoethnographic reflective study of a program that brought together specialists from around the world in an intensive "summer school" on responsible AI in 2023 led by Mila - Quebec Artificial Intelligence Institute. Founded by Dr. Yoshua Bengio, Mila – the world's largest academic research center for deep learning, is the result of a unique collaboration between Université de Montréal and McGill University, in close collaboration with Polytechnique Montréal and HEC Montréal. Mila's mission is to be a global pole for scientific advances that inspires innovation and the progress of AI for the benefit of all.

In this paper have included reflections from organizers, speakers, and 25% of Summer school participants, including four participants and one organizer who are co-authors on this paper. An engineering education researcher not part of the cohort or program, who is the last author on the paper, helped the authors ground their reflections towards this paper. Throughout the paper we provide rich descriptions of the planning, activities, and impact of the program. Ultimately, we agree with Van den Beemt et al.: “If we can better understand the constraints (institutional or cognitive) which inhibit the development of interdisciplinary programs and the background circumstances, including elements of facilitation, important for a program's success, we may be better able to transfer educational strategies that are successful in one context to another or at least describe the conditions under which a program design might be most effective” [7].

The research questions guiding this study are:

> **RQ1: Planning for impact:** How did the program design enable a more effective understanding of interdisciplinary problem-sets?
>
> **RQ2: Working together for impact:** How did participants experience the interdisciplinary work of the program?
>
> **RQ3: Measuring impact:** Did the program affect the participant's impact on interdisciplinary problem-sets after the program?

Related Work

There are challenges and opportunities in training engineers for interdisciplinary collaboration. To ensure that solutions are well and safely adapted to the need, it is pertinent for people with technical knowledge to successfully communicate that knowledge and to seek out and include intersecting expertise in their reflections. Borrego and Newswander underline challenges and opportunities for engineers with interdisciplinary training: “The very disciplinary silos and discourse communities that stand as barriers to interdisciplinary research and education also serve as barriers to combining and transferring this scholarship in ways that would be informative to sciences, engineering, humanities, and social sciences alike” [10].

Collaboration with individuals with diverse perspectives leads to rich and creative solutions, especially to poorly structured problems that are common in engineering. This is true in the everyday interactions that engineers may have in work teams, as highlighted by Felder [11], Ventura [12], Chowdhury et al. [13], and is essential in complex, real-world problem-solving, too [14]. It is vital when the stakes are high, such as work to do with climate change, health, social unrest, war, and high-risk emergent technologies. There are some concrete examples to consider to illustrate how collaboration makes for better tech implementation: for example, airplane safety standards need input from mechanics, engineers, pilots, airlines, passengers (users), and airports. In contrast, the airline industry fails to include and accommodate wheelchair users [15], which leads to technical and social challenges. Another example is the development of weaponized drones without having a regulatory mechanism for who can use them, when, and to what end. In contrast, many international treaties represent agreements to share science, coordinate infrastructure, mitigate conflicts, and other collective, multi-disciplinary efforts for peace [16]. Collaboration makes better technology and also better policy.

Traditional technical engineering approaches focus on specialized knowledge and skills [17]. In comparison, infusing liberal education into this framework can provide engineers with a diversified intellectual and strategic lens, a broader understanding of context [18], a more effective professional network, and enhanced technical skills. Øien & al have found that: “more emphasis on student-active teaching methods in engineering programs may indeed improve students’ learning of a broad set of future-relevant engineering competences” [18]. Liberal education skill sets emphasize critical thinking, creativity, communication, empathy, and problem-solving abilities, which are all essential for engineers to address complex, real-world challenges [19],[20]. Through exposure to diverse perspectives and ways of thinking, engineers develop a nuanced understanding of the world, including stakeholder and social-contextual factors [21],[22]. This can lead to more creative and effective solutions [23],[24] [25], and foster a deeper understanding of the social, cultural, and ethical implications of technological design choices. With such training, engineers can also be empowered to have a more significant impact on society [26],[27] [28]. Borrego and Newswander remind us of the role for educators in this process: “engineering faculty can seek opportunities to engage various epistemologies in their courses, thereby promoting the cognitive flexibility of students and preemptively preparing them for some of the roadblocks generally attributed to a narrow engineering point of view focused on technical details at the expense of societal impacts” [6].

In a situation that is in some ways analogous, scientists who are working on the energy transition have suggested a reflective reproach and that in the case of the rapid changes brought about by climate change, people working on solutions need to be "working not only to hear different social groups, but to involve and validate insights gleaned from potentially radically different epistemic positions…likely to increase long-term legitimacy, and reduce chances of surprising forms of contestation down the line" [29]. Though the comparison is not perfect, like for climate change, the scope of AI is global, and involves a great many people in different fields, both technical and nontechnical, working together. At the same time, there are some indications of institutional and processual barriers to effective interdisciplinary work.

Challenges in AI Education

AI has no universal definition. Søraa proposes that “AI as a technical artifact also constructs social realities, not free from bias, and we must open the black boxes of technology to gain a holistic under-standing of how the technical and the social impact each other and dwell in symbiosis” [30, pp.17] From that basis, this study aims to understand best practices in the design of educational programs for engineers that can empower impactful work, specifically in the interconnected social and technical fields involved in the development of AI. For our present purposes, we are using a broad definition of the field AI to include people from any sector that is involved or affected by AI. Our perspective aligns with Tecuci who underscores the broad scope of AI as “ the Science and Engineering domain concerned with the theory and practice of developing systems that exhibit the characteristics we associate with intelligent inhuman behavior” (58, pp. 168). The roots and various disciplines of AI set a backdrop for considering the need for interdisciplinarity. Tecuci continues, “AI roots comprise not only computing disciplines, “but also mathematics, linguistics, psychology, neuro-science, mechanical engineering, statistics, economics, control theory and cybernetics, philosophy and many others” (pp.168). This underlines the pertinence of training people in interdisciplinarity, with content and perspectives developed at the intersection of multiple disciplines.

However, the design of current AI education programs often does not fulfill the need to develop a holistic understanding of the relationship between society and technology. Langley calls attention to common shortcomings identified in AI educational programs in highly ranked universities across the United States [31]. The flaws span from teaching AI as a collection of isolated algorithms to the omission of important topics and key theoretical ideas. Langley’s findings provide a rationale for integrating discussions and ideas commonly in the realm of the humanities and social sciences into AI course design for engineering education [31]. Their study found that “problem areas like qualitative reasoning, analogy, and creativity are ignored in favor of ones that are more easily formalized” [31]. Promoting critical thinking and creativity through interdisciplinary approaches to problem-solving can set the basis for qualitative reasoning beyond quantitative analyses. It also allows for deeper reasoning on the interplays between society and technology.

These findings echo Mishra and Siy, who warned that “a Computer Science centric approach to AI courses does not adequately connect AI to its roots in philosophy, neuroscience, psychology, cognitive science, linguistics, economics, social science, etc." [32, pp. 397]. These authors propose a multi-disciplinary approach to AI education, underscoring the multiplicity of fields that can converge under this vision, including philosophy, neuroscience, cognitive sciences, economics, linguistics, social sciences, ethics, software engineering, computer algorithms, computer architecture, data science and mathematics. Because it is aimed at educating learners to tackle complex problems, engineering education constitutes an ideal field to embrace an interdisciplinary approach to AI education.

Experiential learning approaches like project-based courses that are commonplace in engineering education are valuable approaches to AI education. Eaton shared experiences teaching the courses "AI for Robotics" for second-year and up graduate students, as well as "Computational Sustainability and Assistive Computing" through socially impactful projects to undergraduate students [33]. Both experiences allowed the instructor to highlight elements of organizational challenges to consider. He underscores the necessity of a flexible curriculum, agile development methodology, and openness in the project requirements, pointing out how "the multidisciplinary and project-driven nature of the course makes it possible for students with diverse backgrounds to contribute to and benefit from it" [33, pp. 14]. Similarly, projects born in collaboration between academia and civil society organizations have shown the value of interdisciplinary AI education for participants across diverse backgrounds and disciplines. For example, the AI & Equality Workshop by the non-profit organization Women at The Table and the École Polytechnique Fédérale de Lausanne, in consultation with the UN Office of the High Commissioner for Human Rights, included a "Human Rights module as well as a Jupyter Notebook filled with code that illustrates how human rights interplay with decisions made at different points of the data and model lifecycle" [34, para. 1]. Thus, the literature favors an interdisciplinary approach to understand and tackle the challenges posed by AI.

An AI-specific perspective calls not only for students to understand computational and engineering techniques and methods for AI development but also to critically evaluate the systems in the context of society. The several societal challenges posed by the adoption of AI systems in most sectors demand this holistic perspective if we are to tackle AI responsibly. Dignum explains: "Most current AI and robotics curricula worldwide deliver engineers with a too-narrow task view. The wide impact of AI on society requires a broadening of engineering education" [5]. AI-literacy can be considered in its cognitive, affective, and sociocultural dimensions:

> "The cognitive dimension refers to the provision of education on AI concepts such as machine learning, algorithms, data mining, neural networks, natural language processing, and deep learning; understanding them; and developing adequate competencies to use them. The affective dimension refers to the empowerment of learners to be confident in digital environments and to believe in their own abilities to engage with AI. Lastly, the sociocultural dimension concerns learners' ethical awareness and ethical use of AI so that one understands the potential risks and benefits associated with AI adoption" [37, pp.14].

One could add more elements under each dimension, but the above mental model provides a backdrop to develop AI educational programs with the holistic understanding demanded of AI-powered technologies. This approach aligns with Salgado, who proposes an AI literacy approach for journalism students, mainly "adopting teaching practices capable of developing students' competencies and knowledge to use and cooperate in creating AI-powered technologies for journalism and developing in them a critical understanding of the relationship between AI and society" [35, pp. 90-91]. This holistic approach is both critical and socially constructive, and echoes Søraa as it "... can help us improve and build better AI systems—to benefit humanity. For AI to be responsible, we need all actors involved in its lifecycle to also be responsible." [30, pp. 108]. Laato et al. surveyed students who took a cross-disciplinary study module on AI, targeting students in all faculties at the University of Turku, Finland [36]. The researchers found that "while a major part of AI education is technical and algorithm-focused, a growing demand exists for more general, societal perspectives on AI such as law, culture, arts and ethics" [36, pp.7].

Methods

In the literature summarized on AI education above, authors were found to focus primarily on quantitative evidence from student surveys [36], [37], instructor reflections [33], or reviews of existent education initiatives [31], [32], [33], [35]. Our paper provides the unique perspective of participants in an educational program based on an interdisciplinary and holistic approach to developing capacities in responsible AI. Our paper builds up from the participants perspectives, embracing this approach using a qualitative and self-reflective perspective. The purpose of such research is to provide others with a detailed understanding of a single, real event. Because the event we chose was well received and apparently impactful, we expect that it can provide a mental model of what can work. We do this using an autoethnographic approach, where four participants (also co-authors of this paper), reflected on their experiences as well as collected reflections from other participants of the conference and organizers and examined organizational documents, to provide a rich description and take-aways for engineering educators hoping to develop similar programs in AI and for other fields with similar scope.

Creswell describes autoethnography as a research methodology that analyzes a phenomenon using self-narratives that would otherwise remain private or buried [38]. Autoethnographic reflections have been used in engineering education to provide authors an opportunity to shift from being an "outsider" to an "insider" in the research, which further enables their voices to be better heard within the community, thus promoting convergence and inclusion [39], [40], [41]. Like Matusovich et al., this study undertook an analytical autoethnography approach [42], borrowing from Anderson [43], and focused on pragmatic reflections and takeaways rather than emphasizing emotions related to our phenomenon of interest [43]. Discussions and takeaways were augmented by drawing from reflections submitted by the global and interdisciplinary cohort of participants, speakers, and organizers on their experiences of the program.

Research quality and explainability were of importance in the way this autoethnographic exercise was conducted. We began with a reflection protocol developed collaboratively by the research team, iterating through multiple meetings. The protocol was intentionally kept broad and general. It did not align with any specific theoretical frameworks (such as those related to identity development, motivation, institutional dynamics, or agency), thus allowing reflections to be grounded in the insights of the participants' experiences and for themes to be emergent and exploratory. The authors used these prompts to reflect on our own experiences and, over a few months, generated several pages of documents individually. In parallel and independently, program organizers, lecturers, and participants were invited to provide a written reflection of their program experience, prompted by several open-ended questions such as: 1) What impact has the program had on your personal or professional life? And, 2) What were your key takeaways from the event? Finally, the co-authors of this paper came together to analyze our own reflections, and augment it using the additional data from our co-participants collected to holistically document the experience, and provide recommendations to be shared at academic research forums, such as the ASEE Annual Conference.

A "research for impact" approach was taken throughout the research process, whereby the authors created a theory of change and a communications plan for making this present study impactful [44]. Network factors and stakeholders were identified from the start of the process and the authors engaged with organizers and participants in identifying key areas of interest for the questions. Of interest was in identifying areas that would be most useful to organizers, cohort members, study authors and ultimately engineering educators, in building on the knowledge gained.

This study seeks to influence and engage engineering educators and program designers, who are uniquely positioned to empower engineers for impact. This work is a component of a larger research agenda and continuing conversation with organizers and participants. A deep dive into understanding the impact of the program is planned in the next project of this multi-phase research study, aiming to understand how to effectively involve a diverse set of professionals in the interdisciplinary and international work on society's biggest challenges, in particular, the challenge of the responsible propagation of AI.

Context: Program in Responsible AI and Human Rights

Figure 2: June 2023, Summer School in Responsible AI and Human Rights 2023

In June 2023, the Mila - Quebec Artificial Intelligence Institute convened specialists from a wide variety of fields to consider ethical and practical responsibility and human rights in AI development and deployment. This training was designed to include liberal arts perspectives and core technical concepts. Thirty-nine participants (Appendix A) were challenged in a think-tank setting to evaluate the impact of hypothetical and existing AI systems on human rights, and to provide multidisciplinary and interdisciplinary solutions to address the potential risks. The cohort was diverse in terms of areas of interest, identity, and geographic representation. There were engineers, programmers, policymakers, lawyers, academics, people from big and small business, NGOs, and public servants within the cohort. By design, the organizers worked to ensure that participants from different disciplines could start collaborating with some common definitions and understanding of the challenges each of them were dealing with in their fields on the broader question of AI, in particular, responsibility in AI via consideration of technical specifications, human rights, policymaking, and security.

The organizers explicitly hoped to shift approaches and outcomes in the international conversation on AI regulation. They had noticed that many conversations were being held “in silos” (their phrasing), between government regulators and only AI manufacturers at the table to discuss policy with them, in part because representatives of other sectors and segments of society were not sufficiently versed in the technical aspects to be able to design effective policies, and in part because specialists, regardless of their fields, were not practiced in connecting their technical knowledge to the critical concerns of people from other sectors.

Guest lecturers for the program (Appendix B) were selected through MILA’s pre-existing global networks with the aim of convening instructors who would ultimately provide the vast dimensions of learning and analytical inquiry necessary for the kind of approach to Responsible AI that they were hoping to instill in participants. The lecturers included several world-renowned specialists in their fields.

The call for applications was conducted through outreach to some 50 organizations in MILA's pre-existing global networks, with a call to action to share in disparate places to encourage a diverse applicant pool. This outreach was primarily conducted via email and social media like LinkedIn and other social platforms. Outreach partners included direct connections, professional associations, post-secondary institutions, think tanks, not-for-profits, private companies, and public sector offices.

Application review was conducted internally and via an invitation to become a technical reviewer, with care for making the selection committee diverse in representation. It was primarily composed of AI programmers but also included educators, staff of the institute, and others. There were three guiding values for selection:

1. That the cohort be as plural and diverse as possible.
2. That people have a baseline understanding and knowledge of AI and/or Human Rights.
3. That candidates have a desire, commitment, and opportunity to have a future impact in their respective professional settings and communities.

Selection was then based on the overall excellence of applications, complementary skill sets, and technical ability. In a post-program interview with MILA's AI for Humanity team, we asked them to reflect on the efficacy and outcome of this process. One organizer shared, "We were pleased with the outcome of the application process and criteria. Upon reflection, we were happy with the amount of diversification and were pleasantly surprised by the younger demographic of the cohort." And, "in the future rounds, we will invite summer school alumni to join the committee and act as reviewers as well."

When asked about the challenges of the selection process and any unfortunate outcomes, they shared that 3 or 4 participants were unable to come due to visa delays. This outcome was distressing to the MILA team, who, as a result, made timeline adaptations for the 2024 cohort and beyond.

The participants came to Montreal, where they took part in a series of lectures, workshops, design challenges, and presentations that illuminated presumptions and prejudices through a technical, ethical, social, and legal lens (complete list of activities in Appendix C). Following lectures, participants did hands-on AI case-studies. In addition to the week-long group case studies, the mid-week project was a large collective case study on AI's uses for the prediction of antibiotic resistance conducted by Concordia University. At the end of the week-long program, there were group presentations and roundtable discussions. This allowed for a variety of perspectives to emerge on different topics, time for questions, and inspiration for post-program plans.

Participants have generally deemed the program delivery to have been strong and the event a success. Many have continued to create additional opportunities for education, public dialogue, and impact in their respective environments. Considering these indications that the program was a success, this study's research objectives are meant to draw from that collective experience and provide insight for engineering educators designing similar skill-sharing events between engineers and students and professionals from other disciplines, especially those stemming from a specific need to take a multi-sectoral approach. With that in mind, this study of that program, as well as reflections on this interdisciplinary collaboration and measures of the program's impacts, was a valuable opportunity to examine our research questions and derive recommendations to enable similar programs by other educators.

Results

This section discusses the study's results and presents recommendations on what program designers and educators can do regarding best practices for program design, implementation, and monitoring. It aims to provide a window into a model for building this kind of education for integrating engineers into more extensive society-wide conversations, where their technical knowledge needs to be translated into social policy and be mitigated in its turn by social policy towards responsible innovation. For each research question, the authors have presented common themes, unexpected or novel information unearthed from the autoethnographic reflection, and referred to existing research or potentially applicable theoretical frameworks from engineering education literature.

RQ1: Planning for impact: How did the program design enable a more effective understanding of interdisciplinary problem-sets?

Interdisciplinary design principles were foundational to curriculum planning for MILA's Summer School in Responsible AI. A holistic approach was taken to pose technical questions for consideration as well as legal, public policy, corporate, and ethical issues. This had a dual purpose: for different people to be able to weigh in to share knowledge of interventions and to act as an instructive tool to educate participants on the considerations required for AI case analysis.

This approach echoes findings in the AI education and engineering education frameworks. Literature (e.g., [5], [32], [36]), highlight the need to embrace multiple disciplines into AI education to effectively tackle the complex nature of the socio-technical challenges of using AI systems across different realms. The organizers operated from the approach that assessing the intersection of AI and Human Rights should be done proactively rather than as an afterthought–beginning with creating space for interdisciplinary dialogue. As MILA's Talent and Learning Project Manager, Solenne Savoie, explains:

> It started with the question: how do we go about doing this? We knew we did not have the tools in place. But before we thought about tool creation, we needed to create the space for dialogue. And we knew that dialogue had to be totally intersectional: interdisciplinary, global, multi-sectoral, and inclusive of grassroots communities as well.

Three key planning aspects emerged from the research process. Lecturers had to come from a variety of fields. The participants had to rapidly feel a sense of community. And the exercises and activities had to provide opportunities for capacity building in the participants.

Lecturers and participants from a diverse variety of places, institutions, and fields

The program design aimed for a holistic understanding of Responsible AI philosophy and practices by designing a curriculum that included instructors from many fields. They included academics and practitioners from ethics, law, political science, computer science, and professionals who conduct AI technical education, operate AI practices, international bodies, not-for-profits, and think- tanks, in addition to public servants, who are currently challenged in intensive policy-making roles to attempt to regulate AI.

The program also drew on the cohort's knowledge, allowing peer-to-peer education, learnings, and insights to cross-pollinate. The cohort participants were carefully selected to represent as many demographic groups as possible to ensure a wide scope of perspectives and skills, hoping to create new connections between specialists and provide the AI ecosystem with nuanced and broadly connected practitioners. It was interesting to note that participant biographies indicate that many of the people selected have multiple disciplines themselves.

In a post-event survey, participants shared the value of this diversity approach, including one participant who shared, "This newfound knowledge and awareness have become integral to my work and daily life, influencing how I approach professional challenges and personal viewpoints regarding AI and its role in our world." Another study participant, a lecturer, commented, “The program gave me a wide aperture and felt like the beginnings of a broader AI dialogue with a wider pool of community members within the AI ecosystem.”

Co-creation of values

It had been assumed by the organizers that bringing together a diverse, intersectional, and multidisciplinary group would operate most harmoniously with an intentional approach to co-creating shared values for working together. The responses indicate that participants agreed. For the program, MILA drew upon the cutting-edge facilitation skills of the Mischief Makers organization. Together, the cohort chose specific values for how they would collaborate over the week. These were:

1. Allocate needed time and space: Participants needed time for pre-work and preparation to the table informed and ready to collaborate.

2. Multi-method approaches: Collaboration and learning through various methods would be valued including but not limited to storytelling, scheduling silence into meeting cadences so people would have time to think prior to contribution, and most importantly, centering intercultural communication with an appreciation and respect for difference.

3. Active listening and learning: participants have different specialties, lived experience, foci, angles, and priorities. Baselines were established so participants could operate on foundational definitions and take an equity-informed lens to the work.

4. Respectful disagreement: the cohort would establish a space for healthy tension and respectful debate. They would allocate enough time to work through barriers.

5. Interdependence: this meant empowering every actor and respecting their contributions. This would push back against traditional and singular ways of knowing and being and further an equity-informed approach towards placing equal value on diverse voices, and especially underrepresented voices in STEM including women and racialized individuals.

Hands-on challenges and working groups

Hands-on activities and teamwork were core to the program design (Appendix C). This approach is consistent with propositions found in the literature and reviewed earlier concerning the viability of experiential learning for AI education. As the experiences brought by Eaton [33], and Women at the Table [34] reveal, these practical approaches can span from project-driven courses to workshops. In the case of the MILA program, the workshop style allowed participants to get involved in group challenges that took different shapes, and turned them into active learners. Group challenges and co-work were designed to be integral to the learning, including workshops, the mid-week major collective case study, and week-long small group case-studies.

In keeping with the program, each group was challenged to work through a case and present recommendations at the end of the week to a panel of government and private-sector judges, including a major consulting firm. One example of these cases studies was considering the effect of AI within elder care. In this case study, an AI “care bot” exists to supplement a human personal support worker and provide health monitoring, social interaction, and basic healthcare support. The small working group for this case was asked to examine ethical principles in health care and AI to consider whether AI could be conditioned to care for others, what technical specifications might affect the user experience, and what might be appropriate for serving and engaging with a vulnerable, elderly population.

Another of the challenges consisted in assessing the societal impact of an hypothetical AI-supported platform for university admissions. The prompts for the analyses included determining the following aspects: intentions, objectives, technical objectives of the model, deployment contexts, stakeholders involved, competitors, vulnerable communities potentially impacted, secondary groups, opportunities, risks, and potential harms (including the likelihood of each, and importance to each stakeholder), and potential problems and solutions.

The challenges were connected to the lectures, as they covered human rights assessment, harms and risks evaluation, governance and policy considerations to assess AI systems from a holistic standpoint.

The teams were challenged to think of solutions in an interdisciplinary dialogue not uniquely anchored in their disciplines. This dialogue demanded a translational approach where each team member had to explain their own concerns and potential solutions in comprehensible language, and be ready to creatively think of how their solutions could be complemented and improved by other approaches shared at the discussion table. The participatory workshops during the week set the conditions (trust, active listening, teamwork) to build up solutions at the intersections of their respective disciplines.

For example, in the case of the university admission team, one of the solutions for a potential challenge associated with data security was setting predefined thresholds (based on historical statistics) for minorities in all programs, to compensate for biases in the data. This approach built on computational, statistical, legal, and social justice considerations, integrating all concerns.

Other challenges included systems related to democracy, facial recognition, disease control, and workplace applications. All group challenges were complex and involved human rights impact assessments, public policy and economic analysis, and technical considerations.

As mentioned, teams were invited to present their analyses to a group of policymakers, computation scientists, lawyers, and business people. The need for sharing their assessments to a wide range of experts demanded creativity to effectively communicate assessments and potential solutions. Furthermore, approaches reflected team skill sets. For example, the facial recognition team was asked to consider how law enforcement might use these technologies. Their team included a Canadian policymaker and a lawyer along with two engineers, a tech CEO, an engineering educator, and a human rights activist. In addition to the assessment and recommendations, this team prepared a draft for a potential Canadian law and a technical briefing on system design considerations. All the teams had multiple methods to communicate their findings. Other approaches included sample regulations, a web page, human rights and risks assessments, humor, and more.

Program planning and design choices by the organizers were meant to line up project aspirations with results, namely, to enable interdisciplinary collaboration in AI and equip the cohort to engage in AI development and policy in such a way as to integrate technical realities, ethics, and human rights into their work. This is consistent with proposals by Borrega and Newswander and Van den Beemt et al., who highlight the potential positive impact of engineer-non-engineer collaboration for complex problem-solving [6], [7].

RQ2: Working together for impact: How did participants experience the interdisciplinary work of the program?

An interdisciplinary approach was imperative with a diverse cohort in terms of backgrounds, cultures, and professional positions. Establishing common ground to promote insightful conversations was a core concern for the organizers. As cross-discipline conversations, hands-on challenges, and workshops were essential parts of the learning, it is interesting to explore how people responded to these experiences. From the autoethnographic reflections, interdisciplinarity emerges as a critical element in building new knowledge, anchored in two main aspects: learning from others' perspectives and establishing a common language for the conversation.

Learning from others

The program raised participants' awareness of the urgent need to embrace an interdisciplinary approach to AI and the complex nature of an evolving field. The desire to hear others' perspectives was part of their initial motivations, which revealed an implicit recognition of the productive nature of collaborative work. A participant reflected on this as a key reason to attend. They "wanted to learn about the discourses and practices of 'responsible AI' and how others are making sense of this changing fashion/mode in AI." The reflections echo the organizer's aspiration of creating a shared understanding of the various factors at the intersections of human rights and AI technologies.

The autoethnographic reflections provide noteworthy nuances linked to the participant's backgrounds. For example, while a respondent in a leadership position framed the course as an opportunity for exchange and knowing "the state of the art" concerning debates on Responsible AI and human rights, practitioners in technical fields tended to appreciate learning about solutions to tackle ethical problems. People from social fields tended to want to understand the technologies better. Respondents with technical and non-technical backgrounds agreed on the importance of collaboration in advancing the conversation on responsible AI.

> Technical individuals often lack legal or ethical viewpoints, just as those from non-technical backgrounds might lack the technical insights…In my professional journey, I've come to realize that responsible AI isn't confined to the algorithmic realm; it demands a joint effort from all involved in handling data and algorithms.

Likewise, a perspective from a technical background highlights the necessity of filling those gaps and finding common understanding:

> … technical insight would help individuals with non-technical backgrounds understand the intricacies, challenges, and limitations, bridging the knowledge gap and enabling them to contribute meaningfully to the responsible AI discourse within the technical community.

These reflections demonstrate the importance of cohort selection for a balance of people with technical and non-technical knowledge, and complementary fields.

Respondents brought up the challenges associated with interdisciplinary work that emerged from the group case studies that evaluated hypothetical AI systems. A participant underscored the productive nature of intellectual debate in multi-disciplinary teams: "having friction or differences in opinions or perspectives to the same problem." Many participants indicated that various opinions on a particular matter can positively impact values like fairness and transparency in AI systems. As with Borrego and Newswander's engineer/non-engineer team subjects [6], many technical and non-technical participants expressed pleasure with the broader technical context afforded them by conversations during the program.

Common language

The pivotal importance of setting common ground was highlighted by referring to "shared lexicon," "common language," and "shared understanding." A participant vividly described these issues: "The intersections of feminism, inclusion (representation and de-biasing AI), accessibility, and the exponential effects of AI on democracy are system-wide issues and require an interdisciplinary approach."

At the same time, as some respondents noted, the process is not free of friction. Consequently, training students to practice interdisciplinary collaboration and planning for the facilitation of interactions and, often, a translation process between people from different disciplines may be essential to creating a shared lexicon and making the best from emerging disagreements. With a common language, said one participant, “the easy problems get cleared up, and we are left with a clearer understanding of the wicked ones”. In their study of interdisciplinary research projects, Borrego and Newswander reported: "specific statements (descriptions) of the audience for interdisciplinary communication were both science and nonscience audiences" [10]. They continue: "we note that 14 proposals included only vague statements that students would cross disciplinary boundaries; however, such boundaries could not be clearly defined or categorized based on the immediate context of the statements" [10]. Their findings imply that this MILA program and others could benefit from a more explicit mapping of participant's fields and the specific boundaries they might expect to encounter. Taking up Borrega and Newswander's challenge and providing a guideline for program creation [10], Van den Beemt et al., found that: "prompting the students to move between... representations repeatedly... calls upon reasoning strategies that cross disciplinary boundaries" [7].

One participant, a person working in a very challenging technical field, expressed relief to be talking with people who could understand their work on a basic level and, with that knowledge, help them to understand, in return, how to face some of the ethical consequences and questionable practices in the facial recognition technology they are working to advance. They said it was lonely and that this opportunity was practical and relational. Several participants from the social sciences expressed a similar feeling: they had already formed a good basic understanding of the technology and had been struggling to communicate with their colleagues about it.

These explorations of interdisciplinarity revealed the critical relevance of building shared meaning and opportunities for conversation of the sociotechnical issues around AI. The reflections show that training for practitioners and academics in interdisciplinary dialogue and practice is a professional necessity for people who want to develop sustainable and actionable responses to the challenges posed by the growing adoption of AI-powered technologies.

RQ3: Measuring impact: Did the program affect the participant's impact on interdisciplinary problem-sets after the program?

Respondents highlighted the impact of the Summer School in their careers and personal lives, in academia, industry, government, and civil society organizations. This was MILA ’s objective: to train and empower a multi-sectoral group of leaders to take learnings from the school and conduct education, knowledge translation, and enable responsible AI practice within their fields. Impact. Three categories emerged that encapsulate this impact: change, agency, and community.

Change

The knowledge acquired during school and the intellectual exchanges sustained with peers and presenters appear in the autoethnographic reflections as factors that trigger a mindset change toward AI. A respondent framed the potential of this collective construction of an interdisciplinary and humanist vision of responsible AI as a point of inflection concerning perceptions about ethics and AI, highlighting how the program "has reshaped my perspective on the ethical implications of AI technologies." Similarly, another respondent came to the awareness "that responsible AI isn't a one-dimensional challenge," explicitly stating how "having not been formally trained in legal or philosophical thinking," the human rights frameworks were initially outside of their considerations.

This shift from perceptions anchored in one field to a broader, complex, and multidimensional understanding of the technology and its potential reach is critical in pursuing change - through action - in organizations and social environments [17]. Then, change becomes framed as a personal-professional goal and the individual seeks change in the AI ecosystem as a duty [19]. Phrases like "making me more aware of their impact on society and various communities," "I plan on growing it from here," "it shaped my path," "has completely transformed my professional practice," "I realized I was needed in this space," etc. reflect the profound impact of the program as a catalyst for change.

These findings reinforce the relevance of embracing a humanist perspective in AI education. As Fisher and Mahajan [3] and Kim et al. [45] show, engineering educators have long been calling attention to the need to integrate liberal arts and humanist perspectives into engineering curricula. The multidimensional nature of AI is a case in point.

Agency

With the new perspectives, there appears to be a strengthened feeling of agency for participants, who then come to see themselves as agents of change. A participant shared: "I realized I had a lot to learn but also something to say." another said, "I filled an important gap in representation." In contrast, others became aware of their ability to bring "unique skills" to the discussion. The comments reveal how they could build the confidence for action: "I was relieved of my own imposter syndrome and self-censoring by the camaraderie of people I admired, who admitted en-masse that they felt the same way about themselves." Another participant stated that the course provided "confidence and motivation to promote responsible practices and the integration of human rights when building AI systems."

Across the responses, a common feeling is noticeable: inspiration. Participants repeatedly expressed that the learnings, informal conversations, and hands-on activities have inspired them. Inspiration is a crucial element in building a sense of agency and constructing a theory of change, which is to say, inspiration gives people a reason for making a change [46]. A respondent framed inspiration as a trigger to assume new challenges, a "door to exploring technical knowledge without fear." In another response, agency builds upon the holistic vision of AI offered by the program: "Within my workplace, I was the sole contributor to responsible AI efforts, operationalizing it in practice, which limited my ability to offer guidance beyond the algorithmic realm." Agency here is constructed from a holistic understanding of AI and the opportunities to get involved in intellectually engaging conversations. As a respondent highlighted, being "more aware" of the challenges at the crossroads of AI and human rights and crossing the frontiers of their disciplines are critical takeaways from the program. With the expression "this realization fueled my commitment", a participant encapsulates how agency intersects with a commitment to have an impact.

Community

New knowledge was being translated into inspiration to pursue change. Post-program actions by participants span from incorporating the responsible AI and human rights perspectives into computer science and law programs to technical project design, participation in conferences, the delivery of lectures, and the creation of collaborative efforts for research and policy impact, like The Aula Fellowship for AI Science, Tech, and Policy[47]. At the core of these initiatives is the intention to build and be a part of a community of responsible AI practitioners. This idea emerged as essential in the reflections.

The relevance provided by participants to the community-building process aligns with the deliberate intention of the program organizers, who envisioned creating a worldwide community of practice for responsible AI. The responses describe the place that the notion of community occupies. A respondent highlighted: "The program helped to visualize a shared goal as a community: we shared a common goal, and we were all united by a shared commitment to advancing responsible AI practices." From this comment emerges the key relevance of shared interests to develop a shared culture of engagement. As an educational initiative, this means that the program can create a culture of responsible AI, to which a sense of collective belonging is essential.

Focusing on engagement, from the course design phase and throughout, impacted participants' learning experience. The program enhanced group engagement by promoting active participation and teamwork, constituting the first step in creating a community. A participant revealed how this approach was essential in the learning experience: "Group activities- they have made me more aware of the intersubjectivity around algorithmic impact assessments and the challenges in quantifying human rights, let alone the meaning and measures of responsibility/ethics/safety as in product safety." The collaborative activities provided space to consider real-life scenarios for AI systems assessment. This approach planted a seed for a broader, longstanding network of collaborations, including the one that brought this study together. Respondents expressed that these activities enhanced "understanding and skill," inspiring them to be "more intentional about…collaborations and communication" and, for many respondents, more aware of the need for diverse, interdisciplinary voices.

Improving the program

The organizers want to be responsive and evolve to address wicked challenges and timely issues. When we asked the MILA team about emergent 2024 priorities and updates to the curriculum, they shared that in the next iteration, they were hoping to cover a wider range of subjects, including the impact of AI on:

- Climate and the environment
- Democracy and geopolitics
- The invisible side of AI and vulnerable workers
- The political economy of AI
- Technical considerations such as computing power (compute) and infrastructure.

As well as an additional month of lead time to ensure that participants from everywhere have a chance to attend. This indicates that they have responded to the participants' comments, which seems essential to make the program as effective as possible. Brajkovic suggests that the principles of cybernetics can be of use in program design for engineering education, in that these principles would provide for higher quality communication of procedures to students, particularly through closed-system feedback [48]. Which is to say, the organizers could benefit from exit interviews and other feedback or debriefing tools.

Considerations for Educators and Program Designers in AI

In seeking to understand how the program was planned, executed, and monitored, we have been able to identify some factors of success and difficulties, drawing both from our own experiences as well as prior literature, that may be of use to educators and program designers, especially those who are interested in the AI space. The recommendations are not novel, but independently were found in this study, and are grounding for prior literature. Our results expand on this because of the AI context which is more multidisciplinary than traditional engineering courses, since it brings in people from policy, law, advocacy, activism, etc. in addition to engineers. We have formulated some considerations meant to reinforce best practices from engineering education research, augmented by our experiences as part of the MILA program, from a pragmatic lens. These recommendations are thus intended for educators to enable current professionals who enlist as students of a short program to become more impactful in their AI careers and in society.

Planning for Impact

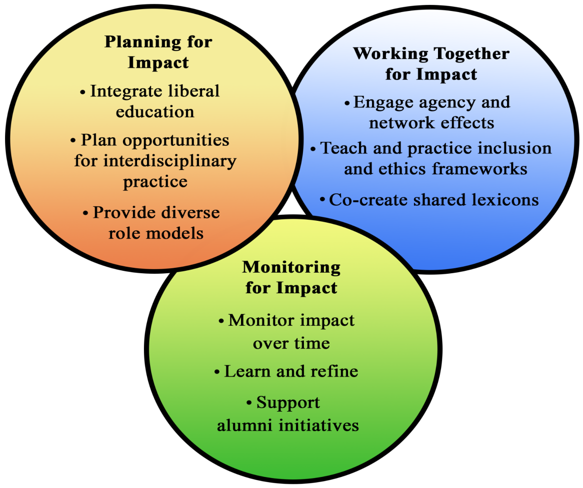

Figure 3: AI Program Design for Impact

1. Integrate liberal arts and social sciences into technical discourse.

The reflections in this ethnographic study show that infusing elements of liberal arts and social science into a program can promote knowledge acquisition and skill building, in particular critical, creative, and systemic thinking, in professionals and students from technical fields. The school provides an example of how to fulfill a call to integrate creativity and critical thinking in AI education [33] and broaden the approach to teaching robotics in EE [5]. Social studies of technology can help to understand AI systems in a non-deterministic perspective, allowing us to move away from the technocratic understanding of AI impacting society and embracing the dual character of this relationship where society and technology are mutually constituent [49]. A respondent highlighted the profound impact of embedding social a sciences perspective into the understanding of AI:

“ What I found particularly noteworthy during the program was the evident gap in perspectives. Technical individuals often lack legal or ethical viewpoints, just as those from non-technical backgrounds might lack the technical insights. This realization fuelled my commitment to bridge these gaps, emphasizing the crucial role of effective communication in fostering a holistic understanding of responsible AI across diverse teams”.

This comment also echoes works in EE reviewed before advocating for bridging the gap between humanities and technical worlds for EE. The literature and findings support this recommendation. Adopting this approach can enhance understanding of the societal challenges posed by AI-powered technologies and the complexity of tools needed to tackle them.

2. Build and provide spaces for interdisciplinary engagement and teamwork.

A program should make time for interdisciplinary training and practice and use facilitation techniques to promote meaningful engagement, for example, incorporating team activities like workshops and group reflections. Providing a variety of ways to engage with knowledge is beneficial to enhance learning experiences and complement new knowledge discussed in lectures. Furthermore, interdisciplinary training enhances understanding, relieves intellectual isolation, and can set the foundations for future community-building, providing engineers with tools to improve solutions fit to purpose. As seen in the discussion section, participants highly valued interdisciplinary as a critical value of the learning experience..

A respondent came to realize that AI is "a collective effort, a collaboration across diverse perspectives", pointing out how "discovering the array of AI governance practices and different responsible AI frameworks, as well as understanding how legal regulations can fortify responsible AI has been eye-opening". From this comment emerges the transformative potential of an interdisciplinary approach to educate about AI.

The case-study analyses, workshops for teamwork, and the One Health challenge provided real-life examples of the need to integrate various disciplines in teams, analyze the impact of AI systems and look for mitigation strategies for the risks.

3. Provide diverse role models.

This recommendation underlines the importance of diversity in the selection of lecturers. There should be lecturers from technical and non-technical backgrounds, bearing in mind the need for educators and practitioners from the Global South and representatives of non-dominant epistemologies and practices. This can provide students with role models and contribute to decolonizing a program, whether in AI or otherwise. Educating engineers in non-hegemonic perspectives can also broaden their approaches to problem-solving. Diversity initiatives must include provision for the safety of participants and space for the community to correct course on the oppression-based or elitist narratives in our global society.

Working Together for Impact

4. Consider agency and network effects as a central factor in empowering people to act.

Capacity-building efforts should integrate initiatives to enhance participants' agency as change-makers by emphasizing how their unique capabilities and skills can make insightful contributions to a broader community. Bringing people together engages them and their networks, and network effects are a powerful way to disseminate a cultural message or a complicated technological one [50]. Deichmann and their fellow researchers also underscore the importance of a common language or lexicon, confirming the intuition of this study's participants. Findings tackled in the discussion section align with this perspective and showed the critical importance of considering how the learning experience can boost individual agency. As an illustrative example for this recommendation, a participant's comment underscored how the course helped them to realize that they "had a lot to learn but also something to say". Organizers and educators should consider how practical activities and lectures can reinforce participants' agency, how individual skills will be integrated into collaborative networks, and what other network dynamics can be constructive to reach program goals.

5. Integrate equity, diversity, inclusion, accessibility, and anti-bias frameworks in engineering education.

Like all of our technologies, AI is being built within social frameworks. In many cases, the applications are mimicking or enhancing existing injustices [30], [51], [52]. Without deliberate education to mitigate bias when it comes to racism, misogyny, and other forms of prejudice, these innovative technologies will continue to have dangerous effects on people throughout the value chain. During the program, it was clear to many participants that they had been missing essential aspects in their work on AI, whether social or technical. Participants in the study expressed gratitude towards the diversity and inclusion considerations taken by the course designers and organizers.

"The aspect that surprised me the most was the diversity, not only among the speakers but also among the participants".

"Though I was initially intimidated to apply, I pushed myself because broader public policy questions like the health and protection of our institutions, the intersections of feminism, inclusion (representation and de-biasing AI), accessibility, and the exponential effects of AI on democracy are system-wide issues and require an interdisciplinary approach".

These comments confirm the imperative of embedding Equity, Diversity, Inclusion, and Justice (EDIJ) considerations into the design of AI courses, integrating learnings in this area from Engineering Education [53], [54]. Also, it showed how the program enabled participants to become better informed and more empowered, building up on EDIJ perspectives. In addition to building collaboration competencies, AI education for engineers must include anti-bias competencies so that their creations do not compound existing injustices and create more harm. The argument of tech neutrality, i.e., "knives don't cut things, people do," has long ago proven to be inadequate to the need to include the ethical responsibility of designers in the eventual uses to which their creations are put [55]. However, this needs to be consistently integrated into technical curriculums.

6. Provide training for work across disciplines in a shared lexicon.

While the lectures should set the basis of a common language for interdisciplinary work, the workshops, and hands-on activities help translate theoretical discussions into action. As these hands-on activities can put together engineers, activists, businesspeople, government officers, lawyers, social scientists, etc., focused on particular problems or tasks, they can provide a glimpse of how interdisciplinary work in other situations might look like, including the challenges of either agreeing on a shared lexicon or the otherwise successful facilitation of communications. This translational aspect was identified through two aspects of the course: the translation of knowledge from lectures to practical activities within the same educational setting, and the translation of knowledge across disciplines. Those learning processes were ignited by the presenters who used a common language, examples to build common ground, and facilitation techniques that encouraged participants to establish a transparent dialogue. For example, the afternoon workshops included an exercise where participants had to explain their jobs/investigations to each other in groups of two. Activities of this nature planted a seed for the conversations required later during the case-study analyses to be presented at the end of the course, as noted by a participant:

"Translating knowledge from one field to another, conversing in a language that for most of us was not our first language, and working against the clock showed how challenging - but rewarding- this path can be. It showed how different our priorities are, how our background influences them, and the need to integrate this approach into university education"

This recommendation calls for deliberately training people in interdisciplinary work through activities of diverse nature, like case studies, experiential projects, or workshops. These activities are opportunities to test approaches for working in multidisciplinary settings based on facilitation techniques for meaningful engagement [56].

Monitoring Impact

7. Monitor the impact.

Measuring impact after a program is essential to determining how the participant's experiences and actions align with the program's objectives and expectations. While an initial survey conducted immediately after the program can help evaluate participants' opinions on the course, follow-ups like surveys and events can help determine how the program has impacted participants' careers. This process can also identify how the program's learnings have translated into initiatives and projects within the field. The information is also valuable to educators in tuning future editions to better suit participant's training needs and meet program goals.

8. Learn and refine future programs.

The purpose of monitoring should be to inform learning and to use learning to refine future programs. We note that the MILA organizers needed to rethink certain aspects for future editions to more closely meet program goals. In keeping with research for impact methodology as it applies to capacity building, a process for education program design, far from being static, should be iteratively undertaken throughout planning, deploying, and monitoring, allowing educators to refine over time and to react to new opportunities to meet learning objectives [44].

9. Support alumni and invest in the long-term creation of a connected alumni network.

In terms of impact over time, it seems useful for organizers to consider and plan for supporting alumni who take up a program's call. Quoting a participant: "I would like to see MILA, and the rest of the cohort continue to actively invest in growing the alumni and actively engaging them too." This quote indicates that people believe the program was just a start. Said one participant: "This is how we build a robust, Responsible AI ecosystem throughout the world." For engineering educators, the benefits of a long-lasting impact and an impact-enabled community harken to the foundations of education: personal empowerment [57].

Limits to This Study

The co-authors of this paper found value in the program described above. However, we were keen to understand how to improve this program for future cohorts and similar programs elsewhere. We acknowledge that people with a negative experience of the program would be more likely to not respond to the survey. Foreseeing this, we explicitly invited critical responses from our peers who also experienced the program and received some. For example, students communicated their disappointment that the global south remained under-represented. Others - more than one, including one notable lecturer - wanted a more critical look at the structures of society in which impact may be required, like the economy, which was mentioned only once by one speaker as a potential threat to the responsible development of AI technologies. That speaker also expressed serious doubts that our economic systems can safely handle AI. Also under-discussed was that this technology has very high costs regarding climate change, energy consumption, and rare-earth mining. However, negative critiques of the program were not the norm, and everyone who answered had much more favorable to say than negative. Because the respondents were self-selected, we do not know what people who did not answer took away from the program. It may be nothing. It may be terrible or wonderful.

One potential participant could not answer in time because they did not have a stable internet connection at their geographic location. This may have been the case for others. Therefore, we can expect that we do not have representative coverage of our target population, partly due to unequal socio-economic situations. We have not attempted to correct for this sampling bias. Consequently, we can’t make any statistical analysis of the responses, nor the frequency of different topics raised. The responses represent individual experiences and suggest specific patterns and possibilities that reinforce the authors' collective reflections, which we have presented in the discussion section. One should not infer that these patterns and possibilities are generalizable. However, we affirm that they are real.

Lastly, this is an ethnographic study and naturally has limitations. We do not intend for these perspectives to be generalizable. Our research is the record of an event that is much more complex than can be reflected in a single study. Instead, we hope to provide some insight and inspire the intuition of experienced engineering educators. One co-author participant put it best: "I learned that there are no right answers because the questions we are asking are involved and deep, and the technologies we are working on are ever evolving."

Directions for Further Research

We are all learning how to navigate the complex challenges that our society faces with regards to AI and in other matters. As such, this study indicates that further research is needed to build on existing scholarship in engineering education and to understand the potential long-term effects of training people in interdisciplinary engagement and giving them tools to build communities of practice around shared values, specifically in AI. In keeping with research for impact methodology, we expect to continue to engage with people in the field of AI to understand what they need to build their practice. Many questions arise. Do the people who express that a program has impacted them continue to make an impact in the field? Is it because of the program? We recall that they were already inclined to make those changes, as we know that people were partly selected for their potential and opportunity for impact. If they engage more heavily with the social problems of AI, are they more effective because of the program? For how long? Conversely, are there bad actors who can use these skills or this community to the detriment of society? How can they do so, and how can we mitigate that? As some participants noted that many of the people in the cohort were also multi-lingual and the CV's reveal they commonly have multidisciplinary backgrounds, it is pertinent to ask: were these a conscious or emergent result of selection processes? These questions need time to pass for useful study and engagement with the people involved. The topics would also benefit from other studies of similar programs, in AI and in fields of comparably wide-scope.

What's Next for the Research Team

For our part, the research team intends to continue to work together with each other and the community of practice in responsible AI. This is to better understand these processes as scientists, to communicate our understanding, and to engage in the broader issue as practitioners. Like engineering, science is big, and so are some of our societal challenges. These potential directions for further research are an extension of what we do not know and an indication of what is undoubtedly known by others but not by us. Consequently, this paper serves as a call to action as we invite insight and further collaboration from anyone interested, especially engineering educators interested in developing programs and curricula for AI.

Conclusion

The findings of this paper shed light on how interdisciplinary interactions in a focused, interactive forum can inform individual and group practice in the field of AI in the future. The results present common and outlying themes in a discussion as well as recommendations, intending to inform the planning of similar events and maximize the transformative potential of such engineering education on participants and society. Similar to MILA, whose mission is to be a global pole for scientific advances that inspires innovation and the progress of AI for the benefit of all, education institutes across the globe (e.g., [59]-[61]) are committed to advancing innovation, and helping their graduates succeed. This study provides engineering educators and program coordinators with examples and recommendations for planning, deploying, and monitoring a program, in this case, an intensive style summer school in responsible AI, meant to improve participants' skills in interdisciplinary work and collective engagement for impact. As such, it offers what social science can always offer: insight and concrete examples of how we can best organize ourselves to build a collective future. Additionally, the study may contribute to the beneficial development of AI technology and to a broader understanding of the challenges and opportunities related to interdisciplinary collaborations, particularly those related to the responsible development and deployment of new technologies.

As we understand it, these skills will be integral for engineering students and society in the coming years.

We hope that our work can be of use to you.

Figure 4: Group Photo, MILA Summer School in Responsible AI, June 2023

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Appendix A

Table 1: Summary of the MILA Summer School in Responsible AI Participant Biographies

Categories	Details
Fields of Study/Work	- Humanities & Anthropology - Cancer Science & Ethical AI in Healthcare - AI & People Research - Public Law & Technology Law - Data Science & Biotech - Neuro-Engineering & AI - Privacy & AI Law in the Finance Sector - Political Science & International Politics - Human Rights & Technology Law - Informatics & Data Intelligence - Policy & AI Regulation - Neuroscience & AI - Computational Social Science - Machine Learning & Natural Language Processing - Biomedical Engineering & Medical Imaging - AI Ethics & Governance - Computer Science & AI Safety
Roles	- Doctoral Research Fellow & Candidate - Postdoctoral Researcher - Corporate Researcher & Data Scientist - Doctoral Candidate, Lecturer & Legal Practitioner - PhD Student in Various Disciplines - Lawyer & Advocate in AI and Privacy - Senior Analyst & Engineer - Entrepreneur & Founder - Postdoctoral Fellow & Researcher - Government and Public Service Professionals - Master's Student & Intern - Non-Technical Entrepreneur - Senior Manager & Consultant
Backgrounds	- Social Anthropology & Interdisciplinary Social Sciences - Image-Based Data Mining & Tumor Analysis - Mixed-Methods Research & AI - Public Law, Legal Theory & AI Governance - Health-Related Data & Bias Mitigation - Neuromodulation in Neural Networks & Robotics - AI Fairness, Transparency, & Governance - Cognitive & Computational Neuroscience - Political Behavior & Computational Social Science - Privacy-Preserving Machine Learning Algorithms - Synthetic 3D Brain MRI Generation & Medical Image Analysis - Applied Machine Learning & Public Policy
Sectors	- Academia & Research Institutions - Healthcare & Biotechnology - Corporate & Technology Companies - Legal Practice & Consulting - Public Service & Government - Non-Profit Organizations & Advocacy Groups
Common Demographic Traits	- Engagement in advanced studies and research across various disciplines. - Focus on interdisciplinary approaches combining technology with healthcare, law, social sciences, etc. - Involvement in AI ethics, responsible technology, and AI safety.
Uncommon Demographic Traits	- Specific niches such as neuro-inspired AI, AI in agriculture, and AI for social impact in vulnerable populations. - Roles that blend technical expertise with activism, policy-making, or entrepreneurship. - Unique combinations of backgrounds, like blending statistical engineering with machine intelligence or combining legal practice with deep technology specialization.

Please note that the participants were not asked to specify their cultural background nor their genders. As such, we have not guessed and left that information out of this demographic chart.

Appendix B
Table 2: Speakers for the MILA Summerschool in Responsible AI, June 2023

Topic	Speaker Name	Speaker Affiliation	Profession(s)
Responsible AI and Human Rights	Catherine Régis	Mila researcher, Full professor of Law at University of Montreal	Researcher, Professor of Law
AI for Humanity	Benjamin Prud'homme	Executive Director, AI for Humanity	Executive Director
Transparent and Accountable AI	Virginia Dignum	Professor of Responsible AI at Umeå University, Sweden	Professor of Responsible AI
Principles of Responsible AI	Marc-Antoine Dilhac	Mila researcher, Professor of ethics and political philosophy, University of	Researcher, Professor of Ethics
AI and Human Rights	Catherine Régis	Full professor of Law at University of Montreal, Mila researcher	Researcher, Professor of Law
AI Governance	Nicolas Miailhe	Founder and President of The Future	Founder, President
AI System Evaluation and Audit	Lofred Madzou	Director of Strategy, TruEra	Director of Strategy
Ethics in AI	AJung Moon	Mila researcher, Assistant Professor, Dept. of Electrical and Computer Engineering, McGill University	Researcher, Assistant Professor
Keynote	Yoshua Bengio	Founder, MILA	Researcher, Scientific Director
Safety of AI Systems	Shalaleh Rismani	Mila researcher, PhD candidate at McGill University	Researcher, PhD Candidate
International AI Regulation	Nathalie Smuha	Legal scholar and philosopher, KU Leuven Faculty of Law	Legal Scholar, Philosopher
Comparative AI Regulations	Mark Schaan	Senior Assistant Deputy Minister, Strategy & Innovation Policy, Canadian Department of Innovation, Science and Economic Development (ISED)	Senior Government Official
AI and Human Rights Perspectives	Bernard Duhaime	Professor of International Law, Université du Québec à Montréal	Professor of International Law
AI Governance and Human Rights	Karine Gentelet	Professor, Social Science Department, Université du Québec en Outaouais	Researcher and Professor
UNESCO and AI Ethics	Gabriela Ramos	Assistant Director-General for Social and Human Sciences, UNESCO	Assistant Director-General
Perspectives on AI	Maria Axente	Responsible AI and AI for Good Lead, PwC United Kingdom	Responsible AI Lead
AI in Education	Shingai Manjengwa	Director of Technical Education, Vector Institute; CEO, Fireside	Director of Technical Education, CEO
Neuroscience and AI	Blake Richards	Mila researcher, Associate Professor, School of Computer Science and Montreal Neurological Institute, McGill	Researcher, Associate Professor

Appendix C

Table 3: Summary of Activities for the MILA Summerschool in Responsible AI, June 2023

Activity	Description
Specialist lectures	Lectures provided by subject-matter specialists
Afternoon Workshops for Teamwork	Using expert techniques, a professional facilitator prepared the floor for interdisciplinary teamwork. The workshops set the basis for embracing teamwork successfully in an intercultural, interdisciplinary setting by putting into practice communication skills to communicate ideas in cross-discipline, intercultural settings for problem-solving effectively.
One Health Challenge	A Communication team from *Consortium Santé Numérique Université de Montréal* organized a workshop on "AI, One Health approach and antibiotic resistance." The teams were asked to analyze and propose potential solutions for an AI-powered system aimed at predicting antibiotic resistance using patient information.
Case Study Analysis	Each team was assigned a hypothetical AI system to critically analyze potential impact and mitigation solutions from an interdisciplinary perspective. At the end of the school program, each team presented their analyses, including the challenges posed by the systems to human rights and potential paths to address them.