

Mapping Ethics Integration Across Engineering Curricula: Opportunities for Library Partnership

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Abstract

Background: Engineering accreditation standards increasingly emphasize ethical responsibility; however, the integration of ethics within engineering curricula often varies in structure and visibility.

Purpose: This study examines how ethics-related content is distributed and framed across institutional curricula at the University of Illinois Urbana-Champaign from 2019 to 2022. The goal is to identify patterns in curricular signaling and to explore how engineering librarians might use curricular mapping to support ethics education.

Methods: This study employed a curricular mapping approach to analyze publicly available course catalog data, including course titles, descriptions, and departmental affiliations. Courses explicitly referencing ethics, professional responsibility, research integrity, or related terms were coded into thematic clusters reflecting dominant ethical framing.

Results: Ethics-related instruction was widely distributed but decentralized. While philosophy departments maintained sustained offerings, engineering and computing fields incorporated ethics intermittently, often embedding ethical considerations within professional practice or technological contexts rather than as standalone requirements. Explicit connections to information literacy and data ethics were uneven and most visible in computing-adjacent areas.

Conclusions: The findings highlight the absence of a coordinated institutional strategy for ethics integration, particularly within engineering curricula. Curricular mapping offers engineering librarians a practical diagnostic tool for identifying gaps, strengthening collaborations, and supporting accreditation reporting and instructional planning.

Introduction

Ethics has emerged as an increasingly prominent focus in higher education, appearing in accreditation standards, program outcomes, and professional guidelines. However, institutions define and teach ethics in markedly different ways. While some universities integrate ethics across disciplines, others offer it exclusively as a separate requirement or as an elective. These contrasts raise broader questions about how institutions interpret ethical responsibility and how they design opportunities for students to learn and practice it.

While the analysis spans multiple departments, particular attention is given to engineering and computing-related programs due to their accreditation requirements and the growing expectation that engineering graduates demonstrate ethical reasoning in professional and technological contexts. For engineering librarians, understanding how ethics is structurally embedded or marginalized within engineering curricula is essential for aligning instructional partnerships and accreditation support efforts.

This study analyzes ethics coverage across a large research university from 2019 to 2022 to identify the departments offering ethics-related courses and the ways ethics is represented within course content. The analysis does not examine classroom practice. Instead, it focuses on publicly available course descriptions and curricular materials to trace how ethics is framed across the university curriculum. By mapping where ethics appears and how it is articulated, this study provides institutional insight into patterns of emphasis, absence, and disciplinary variation that are often difficult to see at scale.

This analysis of how ethics is represented and framed across courses and departments highlights opportunities for libraries and related academic units to strengthen collaboration, instructional alignment, and impact, particularly in areas connected to information literacy, data ethics, and responsible technology use. The research questions guiding this study are as follows:

1. How is ethics represented across courses and departments within a large research university?
2. Where do existing curricular representations of ethics create opportunities or constraints for library engagement?
3. To what extent do publicly available course descriptions signal connections between ethics, information literacy, and data ethics?

Literature Review

Ethics education programs vary widely in their effectiveness. Some interventions meet their stated goals, but many are only moderately successful in helping students develop ethical reasoning skills [13]. Research also suggests that challenges in research ethics are rarely caused by individual knowledge gaps alone. Instead, they often reflect structural and contextual factors that extend beyond the scope of most training programs [8]. Current responsible conduct of research (RCR) initiatives, while widely mandated, are often criticized for lacking theory-based frameworks that connect instructional methods to learning outcomes [13], [14]. Within STEM fields, ethical considerations are often still treated as separate from core technical practices, with applied ethics research viewed as secondary to disciplinary expertise [12].

Professional accreditation bodies have responded by embedding ethics more directly into disciplinary standards. For example, the Accreditation Board for Engineering and Technology (ABET) requires accredited programs to ensure that graduates demonstrate an understanding of professional, ethical, legal, security, and social responsibilities. Scholars have demonstrated that ethics instruction can be effectively integrated into technical courses with minimal resources, while still broadening students' global awareness and fostering critical engagement [2]. Other studies emphasize concerns related to research ethics in STEM education and the broader contexts in which ethical decision-making occurs [11], as well as the ways students understand disciplinary norms such as intelligence and efficiency within engineering cultures [3].

Engineering and academic libraries have also contributed to ethics education, though their involvement is often uneven and shaped by local institutional contexts. Librarians frequently support ethics-related learning through instruction in information literacy, research integrity, and data ethics, as well as through course-integrated sessions and the development of research guides [1], [19]. Prior work demonstrates how librarians can incorporate ethical reasoning into information and data literacy instruction [1], while other studies show that curricular mapping can be used by librarians to align instruction with academic programs, identify gaps in coverage, and develop more strategic

approaches to faculty collaboration and instructional integration [18]. However, these efforts are typically distributed across programs and often depend on individual faculty collaborations rather than coordinated curricular structures. As a result, the role of libraries in ethics education remains variably defined, highlighting the need for approaches that more intentionally align curricular structures with library-supported instruction.

Beyond STEM, ethics education plays a visible role in other professional domains. Business schools typically align ethics instruction with Association to Advance Collegiate Schools of Business (AACSB) accreditation standards, often framing it in terms of corporate responsibility and professional conduct. In social work and education programs, ethics is tied to professional codes and the realities of practice in diverse communities. Across these examples, ethics is shown to span multiple fields, though the form and depth of coverage vary widely across disciplines.

Recent research highlights the persistent unevenness of this curricular landscape. Studies of research ethics education in university contexts indicate that instructional approaches vary widely and often remain concentrated within RCR training frameworks [10], while broader questions of social ethics and disciplinary practice remain less consistently addressed across curricula. These patterns point to the importance of examining how institutional structures and curricular infrastructures shape the visibility and distribution of ethical education. Building on this gap, this study examines how disciplinary variation and institutional design shape ethics education by mapping ethics-related courses across a single university, offering an institutional view of how ethics appears in the curriculum.

Methods

This study examined the distribution and framing of ethics-related coursework across departments at a large research-intensive university. A curricular mapping approach was selected because it enables systematic analysis of how topics are distributed across formal curricula and how they are represented through course descriptions and institutional structures. Laverentz et al. demonstrate that curricular mapping can be used to examine the distribution, alignment, and characteristics of curricular content across academic programs, highlighting its utility for identifying patterns and gaps in instructional offerings [17]. This makes it an appropriate method for analyzing how ethics-related content is distributed and framed across disciplinary contexts.

Course data was collected from the university's online course catalog for academic years 2019–2022. The catalog includes course titles, descriptions, and departmental affiliations for all undergraduate and graduate courses. The analysis was limited to publicly available catalog data; syllabi and internal instructional materials were not examined. Courses were included in the dataset if their titles or descriptions explicitly referenced ethics, moral reasoning, social responsibility, professional conduct, research integrity, or related terms. This process resulted in a dataset of 41 courses spanning more than twenty academic departments. Each course was recorded in an MS-Excel spreadsheet with fields for department, course number, course title, faculty/instructor, term offered, and course description.

An initial review of course titles and descriptions revealed recurring language and conceptual patterns related to ethics. The analysis identified four thematic clusters: professional responsibility and conduct; applied and technological ethics; social and cultural ethics; and philosophical and moral reasoning. These categories reflected the dominant framing of ethics within each course, rather than the depth of instruction or student learning outcomes, as the analysis was limited to publicly available course metadata and did not include evaluation of instructional depth or student learning outcomes.

Results

This section presents findings from an analysis of ethics-related course offerings across departments between 2019 and 2022. The results are organized to show (1) the distribution of

ethics-related courses by department, (2) thematic clusters represented in course content, and (3) the frequency and stability of ethics offerings over time. Tables 1 through 3 summarize these findings.

Distribution of Ethics-Related Courses by Department (2019–2022)

Ethics-related instruction was identified in 41 courses across more than 20 departments, indicating broad representation across the university (Table 1). Philosophy accounted for the highest number of offerings, with eight courses, representing the largest single departmental contribution. Other departments, including Computer Science, Information Science, Education, and Food or Nutritional Sciences, each offered two to three courses.

Table 1. Distribution of Ethics-Related Courses by Department (2019–2022).

Department	Number of Courses
Philosophy	8
Computer Science	3
Information Science	2
Nutritional Sciences	2
Education, Policy, Organization & Leadership	2
Education Policy Studies	2
Military Science	2
Food Science & Human Nutrition	2
Organizational & Community Leadership	1
Special Education	1
Additional departments, single courses each	16
Total	41 Courses across more than 20 departments

Sixteen departments were represented by a single ethics-related course. While this distribution reflects widespread inclusion of ethics across disciplines, offerings were unevenly concentrated. A small number of departments accounted for a disproportionate share of courses.

Thematic Clusters in Ethics Education

The analysis of course titles and descriptions revealed four primary thematic clusters (Table 2). Courses categorized under Professional Responsibility and Conduct emphasized ethical decision-making within professional and leadership contexts. Applied and Technological Ethics courses addressed ethical issues related to computing, artificial intelligence, and data management and

were concentrated within a limited number of departments. Social and Cultural Ethics courses focused on representation, diversity, and accountability in design and leadership contexts. Philosophical and Moral Reasoning courses engaged classical and contemporary ethical theory and were primarily housed within philosophy-related curricula. Across clusters, professional responsibility and applied ethics themes appeared more frequently than courses centered on philosophical or moral theory.

Table 2: Thematic Clusters in Ethics Education

Theme	Description	Representative Courses
Professional Responsibility and Conduct	Focused on ethical decision-making within professions such as business, education, and accountancy	<i>Ethical Dilemmas of Business, Leadership Ethics & Pluralism</i>
Applied and Technological Ethics	Explores social and professional implications of computing, AI, and digital innovation	<i>Ethical & Professional Issues in Computing, Responsible Data Management</i>
Social and Cultural Ethics	Addresses representation, diversity, and cultural accountability in design and leadership	<i>Ethics of a Designer in a Global Economy, Cultural Pluralism and Ethics</i>
Philosophical and Moral Reasoning	Courses rooted in philosophical traditions of moral reasoning and logic	<i>Contemporary Moral Issues, Ethics and the Good Life</i>

Frequency and Stability of Ethics Offerings by Year (2019–2022)

The number of ethics-related course offerings varied over time (Table 3). This is because some courses were cross-listed or variably scheduled; therefore, offerings are categorized by relative frequency rather than exact counts. The 2019 academic year served as the initial baseline prior to pandemic-related disruptions, allowing for comparison across pre-pandemic, pandemic, and post-disruption instructional patterns. In 2019, course offerings were relatively high, reflecting initial mapping across departments. In 2020, offerings declined, coinciding with pandemic-related disruptions. The course availability rebounded in 2021, with an increase in cross-listed and hybrid courses. By 2022, offerings stabilized, with fewer new courses but continued recurrence of core offerings. These findings illustrate a pattern of broad but uneven distribution, thematic concentration, and variable stability in ethics-related course offerings across the institution.

Table 3. Frequency and Stability of Ethics Offerings by Year

Year	Relative Frequency of Course Offerings	Notes
2019	High (initial mapping year; majority of departments listed)	<i>Establishment of baseline offerings</i>

2020	Moderate	<i>Slight reduction during pandemic disruptions</i>
2021	High	<i>Rebound in course offerings, several cross-listed courses</i>
2022	Moderate	<i>Fewer new courses, continuation of core recurring ones</i>

Discussion

This study was guided by three related questions: how ethics is represented across courses and departments within a large research university; how those curricular representations signal potential opportunities or constraints for library engagement; and the extent to which publicly available course descriptions reflect connections between ethics, information literacy, and data ethics. The discussion that follows interprets these questions through the lens of curricular mapping, focusing on patterns of representation and signaling rather than instructional implementation.

The mapping of ethics-related courses reveals a university deeply invested in the idea of ethics yet uncertain about how to coordinate it. Rather than signaling a lack of commitment, the data suggests a mosaic of localized initiatives, each meaningful within its disciplinary context but rarely connected to a broader institutional vision. The departments with long-standing traditions in moral philosophy continue to anchor the curriculum, while applied fields such as computing, design, and leadership experiment with ethics as professional practice. Overall, these findings illustrate an institution where ethics is both central and peripheral, valued in principle but varied in execution.

For libraries and related academic units, this unevenness represents both a diagnostic and an invitation. By using curricular mapping as a diagnostic tool, libraries can identify departments where ethics is already embedded and use those sites as potential points for engagement. For engineering librarians, this approach provides a replicable framework for systematically identifying where professional responsibility, data ethics, or sociotechnical accountability are already present within the curriculum. This type of visibility is particularly important given that library engagement in ethical education has historically been distributed and often dependent on individual collaborations rather than coordinated institutional strategies. As a result, curricular mapping offers a way to move from ad hoc involvement toward more intentional and sustained integration. This information can guide targeted collaboration, support accreditation documentation, and inform instructional design aligned with existing curricular signals.

This approach aligns with Ferguson et al. [4], who argue that librarians increasingly confront ethical dilemmas that extend beyond traditional codes of conduct, requiring active engagement with evolving technological and institutional contexts. Similarly, Bair and Schroeder [1] demonstrate how librarians can integrate ethical reasoning into data and information literacy instruction, illustrating how library-based pedagogy can strengthen institutional ethics initiatives.

These examples suggest that libraries may be well positioned to support more coordinated approaches to ethical education, should institutional priorities align.

In relation to publicly available course descriptions, the findings suggest that explicit connections between ethics, information literacy, and data ethics are limited and unevenly signaled. While some course titles and descriptions reference professional responsibility, responsible data use, or ethical decision-making, these references are typically framed within disciplinary or professional norms rather than information practices. The mentions of data ethics or information-related concerns appear most often in computing, information science, and select applied courses, but rarely as shared or institution-wide priorities. In many cases, ethical language emphasizes conduct or professionalism without explicitly linking ethical reasoning to information use, data practices, or knowledge production. These patterns indicate that publicly available course descriptions more often imply, rather than articulate, relationships between ethics and information literacy, reinforcing the fragmented landscape identified earlier. Notably, only one explicitly engineering-designated course (ECE 316) appeared in the dataset, underscoring the limited extent to which ethics is structurally embedded within engineering curricula rather than positioned in adjacent or interdisciplinary contexts.

The four thematic clusters identified in this study, including professional responsibility and conduct, applied and technological ethics, social and cultural ethics, and philosophical and moral reasoning, show how ethics education has evolved from a singular moral domain into a complex and interdisciplinary ecosystem. This shift reflects broader changes in higher education, where questions of integrity and accountability are increasingly tied to technological, social, and institutional infrastructures.

These findings confirm earlier studies that describe ethical education as both widespread and uneven [6]. Mejlgaard et al. [13] identified persistent gaps between program objectives and pedagogical implementation, while McDonald et al. [12] observed that ethics instruction in STEM fields often remain peripheral to core disciplinary identity. This study demonstrates those dynamics at the institutional level: ethics courses were found across more than twenty departments, yet only a few were offered consistently from year to year. The resulting patchwork reinforces prior observations that institutional commitment alone does not guarantee curricular integration, revealing how ethical education often depends on localized faculty initiative rather than coordinated design.

More recent scholarship has highlighted similar inconsistencies in the teaching of responsible conduct of research and data ethics [10], [13], [14], along with the continued difficulty of integrating social and technological dimensions of ethics into existing curricula [6], [11], [15]. The present study offers institutional-level evidence that reinforces these findings. In computing and information science, ethics courses appeared sporadically rather than as core requirements, reflecting the same peripheral status identified by [12] and colleagues.

These institutional patterns also mirror broader tensions in digital and social media ethics, where accountability, visibility, and responsibility are shaped by technological infrastructures. In computing education, ethics instruction frequently depends on individual instructors' initiative rather than shared curricular frameworks, producing gaps between aspiration and implementation that echo those observed in higher education [12]. Similarly, Gerrard [7] demonstrates how social media users navigate inconsistent and opaque ethical norms, where responsibility is negotiated rather than systematically taught or enforced. These studies suggest that ethical reasoning, whether in universities or digital environments, often rests on localized practices and individual agency. This parallel reinforces the need for more integrated approaches that connect institutional ethics education with the sociotechnical realities students encounter beyond the classroom.

The scope of this project was intentionally narrow, focusing on one research university and drawing primarily course catalog data rather than syllabi or qualitative interviews. While this approach provided a broad institutional overview, it could not capture how ethics are interpreted or enacted within individual courses. Future work should expand this analysis by examining syllabi and conducting interviews with faculty who teach ethics-related courses. Qualitative inquiry could illuminate how instructors define ethics within their disciplines, how they balance professional standards with broader social concerns, and how institutional structures support or constrain their teaching.

Conclusion

This study provides an institutional view of how ethics is taught, distributed, and sustained within a large research university. By mapping course titles and descriptions, it captures both the reach and variation of ethical education across disciplines. The findings show that while ethics is widely represented, it is not systematically coordinated, relying instead on the initiative of individual departments and instructors.

For libraries and related academic units, these findings point to opportunities for engagement in institutional ethics efforts. Libraries already support research integrity, authorship, and data management, and may be well positioned to help connect disciplinary ethics instruction with broader institutional priorities where alignment exists. Collaborative approaches, such as co-developing instructional materials, integrating data ethics into existing instruction, or curating shared resources, represent possible pathways for supporting more coherent ethical education.

Future research should extend this analysis by incorporating qualitative methods, including faculty interviews and syllabus reviews, to better understand how ethics is interpreted and practiced within courses. Cross-institutional comparisons and the inclusion of additional instructional data could further clarify how ethical education evolves and where opportunities for collaboration may emerge.

Ethics education is strongest when it reflects both disciplinary expertise and institutional coherence. By making visible the current landscape of ethics instruction, this study encourages

educators, administrators, and librarians to view ethics not as a stand-alone topic, but as a shared institutional concern shaped by curricular structures, disciplinary norms, and organizational priorities.

References

- [1] A. S. Bair and R. Schroeder, “Integrating ethics into library instruction: Building critical data literacy in the undergraduate classroom,” *portal: Libraries and the Academy*, vol. 19, no. 3, pp. 403–420, 2019, doi: 10.1353/pla.2019.0023.
- [2] S. Barlowe, “Encouraging global awareness in a computer networking course,” *IEEE Transactions on Education*, vol. 64, no. 2, pp. 195–201, 2021, doi: 10.1109/TE.2020.302836.
- [3] E. Dringenberg, A. Kramer, and A. R. Betz, “Smartness in engineering: Beliefs of undergraduate engineering students,” *Journal of Engineering Education*, vol. 111, no. 3, pp. 575–594, 2022, doi: 10.1002/jee.20463.
- [4] S. Ferguson, C. Thornley, and F. Gibb, “Beyond codes of ethics: How library and information professionals navigate ethical dilemmas in a complex and dynamic information environment,” *International Journal of Information Management*, vol. 36, no. 4, pp. 543–556, 2016, doi: 10.1016/j.ijinfomgt.2016.02.008.
- [5] M. L. Jacobs, “Ethics and ethical challenges in library instruction,” *Journal of Library Administration*, vol. 47, nos. 3–4, pp. 211–232, 2008.
- [6] C. Fiesler, N. Garrett, and N. Beard, “What do we teach when we teach tech ethics? A syllabi analysis,” in *Proc. 51st ACM Technical Symposium on Computer Science Education (SIGCSE)*, New York, NY, USA, 2020, pp. 289–295, doi: 10.1145/3328778.3366825.
- [7] Y. Gerrard, “Beyond the hashtag: Circumventing content moderation on social media,” *New Media & Society*, vol. 20, no. 12, pp. 4492–4511, 2018.
- [8] L. Häberlein *et al.*, “Validation of the mapping of innovative methods and research integrity curricula,” *Research Ideas and Outcomes*, vol. 5, pp. 1–15, 2019, doi: 10.3897/rio.5.e49755.
- [9] D. Hartt, T. Quiram, and J. A. Marken, “Where the performance issues are and are not: A meta-analytic examination,” *Performance Improvement Quarterly*, vol. 29, no. 1, pp. 35–49, 2016, doi: 10.1002/piq.21213.
- [10] R. L. Hite, S. Shin, and M. Lesley, “Reflecting on responsible conduct of research: A self-study of a research-oriented university community,” *Journal of Academic Ethics*, vol. 20, no. 3, pp. 399–419, 2022, doi: 10.1007/s10805-021-09418-0.
- [11] K. Homma, P. Levett, R. Watkins, *et al.*, “Research ethics in STEM education at universities: A scoping review,” *Journal of Academic Ethics*, vol. 23, pp. 1457–1487, 2025, doi: 10.1007/s10805-025-09608-0.

- [12] N. McDonald *et al.*, “Responsible computing: A longitudinal study of a peer-led ethics learning framework,” *ACM Transactions on Computing Education*, vol. 22, no. 4, 2022, doi: 10.1145/3469130.
- [13] N. Mejlgaard *et al.*, “Teaching responsible research and innovation: A phronetic perspective,” *Science and Engineering Ethics*, vol. 25, no. 2, pp. 597–615, 2019, doi: 10.1007/s11948-018-0029-1.
- [14] M. D. Mumford, L. Steele, and L. L. Watts, “Evaluating ethics education programs: A multilevel approach,” *Ethics & Behavior*, vol. 25, no. 1, pp. 37–60, 2015, doi: 10.1080/10508422.2014.917417.
- [15] J. Saltz *et al.*, “Integrating ethics within machine learning courses,” *ACM Transactions on Computing Education*, vol. 19, no. 4, 2019, doi: 10.1145/3341164.
- [16] K. Visscher, “Experiencing complex stakeholder dynamics around emerging technologies: A role-play simulation,” *European Journal of Engineering Education*, 2023, doi: 10.1080/03043797.2023.2196940.
- [17] D. Laverentz, D. Guilkey, and R. Johnson, “Curricular mapping,” *Nurse Educator*, vol. 49, no. 5, pp. E250–E254, 2024, doi: 10.1097/NNE.0000000000001622.
- [18] O. Fritze, M. Lammerding-Koeppel, M. Boeker, E. Narciss, A. Wosnik, S. Zipfel, and J. Griewatz, “Boosting competence-orientation in undergraduate medical education: A web-based tool linking curricular mapping and visual analytics,” *Medical Teacher*, vol. 41, no. 4, pp. 422–432, 2019, doi: 10.1080/0142159X.2018.1487047.
- [19] D. Salo, “Data ethics in library learning analytics,” *Journal of Librarianship and Scholarly Communication*, vol. 12, no. 1, p. eP16245, 2024, doi: 10.31274/jlsc.16245.