# Section 1. Cover Sheet

* Principal Investigator Name: Murillo, Angela
* Position title: Assistant Professor; Program Director - Data Science
* School: Luddy School of Informatics, Computing, and Engineering
* Department: Library and Information Science
* Project title: Critical Framework for Data Ethics and Justice Curriculum
* Amount requested (funds from CTL only): $xxxxxxx
* Co-Principal Investigators (Name, Title, School, Department, Email):

Name: Danbi Yoo
Title: Visiting Assistant Professor
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School: Luddy School of Informatics, Computing, and Engineering
Department: Library and Information Science

* Other Key Personnel (Name, Title, School, Department, Email):
None
* Description of courses or curriculum involved in the project, including enrollment figures in the past three years.
The Data Science undergraduate program at the Luddy School of Informatics, Computing, and Engineering (Luddy-Indianapolis) has been available to students since the Spring of 2019. The program includes the Data Science major with two specializations, two minors, two certificates, two 4+1 accelerated programs, and a collaborative online program. Even with pandemic interference, the program admissions have had steady growth with 6 students in 2019; 33 students in 2020; 70 students in 2021; 154 students in 2022; and 83 in FA 2023. While the Data Science program is a collaboration between two departments at Luddy-Indianapolis, the program is administered by the Department of Library and Information Science (DLIS). DLIS takes specific administrative responsibility for twelve of the core course requirements of the program. These courses include Cloud Computing for Data Science, Data and Society, Data Archives, Data Curation and Management, Data Organization and Representation, Data Policy and Governance, Deep Learning Neural Networks, Foundations of Data Studies, Information Representation, Introduction to Statistical Learning, Surveillance Studies, and Web Mining. As these courses are taken by students outside of the Data Science program, the number of students taking these courses has significantly grown (2019-184 students; 2020-187 students; 2021-228 students; 2022-315 students; 2023-447 students. Additionally, students from many IUI programs take these courses (2019-25 programs; 2020-22 programs; 2021-28 programs; 2022-46 programs; 2023-46 programs). These programs include Informatics, Media arts and Sciences, Medical coding, Health Information Management, Psychology, and many others. Furthermore, these courses are taken by IU Online students in up to 11 programs. Therefore, this project's total reach will impact students not only in the Data Science program but also students outside of IUI through the IU online program. The Master of Library and Information Science (MLIS) program, accredited by the American Library Association, serves as the foundational degree for aspiring professional librarians, emphasizing essential skills for leadership in academic, public, and school libraries and archives. Students delve into contemporary challenges such as information literacy and metadata management, guided by core values including equitable access, intellectual freedom, and social responsibility. As our program emphasizes a holistic approach to understanding information ecosystems, graduates are prepared to address the technical and social aspects of data, information, and knowledge access and creation. Graduates are well equipped to anticipate trends, lead libraries and archives, and foster diverse and inclusive communities. Enrollment in the program has steadily grown over the past several years: 2021 - 313 students; 2022 – 348 students, 2023 – 367; and in 2024 – 442 students.
* Does this proposal focus on integrating ePortfolios within a course, multiple courses, or a program? No

# Section 2. Abstract (250 words maximum)

In the evolving landscape of our data-driven society, integrating ethical considerations with practical problem-solving in data workflows is crucial in both academic and industry contexts. This project employs a critical framework to incorporate data ethics and data justice into undergraduate Data Science (DS) and masters-level Library and Information Science (MLIS) curriculum, emphasizing their relevance in pedagogical strategies and practical applications. Current attempts to include data ethics topics in DS and MLIS courses have been hindered by inconsistent understanding and application of ethics across courses. Instructors often struggle with topic selection, teaching methodologies, and assessment strategies.

To address these challenges, this project aims to: 1) Develop a cohesive pedagogical framework guided by the Data Science Ethos Lifecycle, and review and revise Program Learning Outcomes (PLOs) for DS and MLIS accordingly; 2) Create and test sample assignments in pilot courses in Spring 2025, focusing on synergizing ethics with technical content; and 3) Ensure diversity, inclusivity, and accessibility in Canvas course content and sample assignments. The expected outcomes will equip students with both theoretical insights and practical skills, which are increasingly sought after in the data profession, and offer enhanced career opportunities, especially for underrepresented groups and those with lower tech literacy.

# Section 3. Rationale and Literature Review (250 words maximum)

**What course or curriculum enhancement are you proposing? Why is this enhancement needed? What do you expect to change – in terms of your students’ learning, your program, and your teaching practice?**

This project aims to enhance Data Science (DS) and Master of Library and Information Science (MLIS) programs by employing a critical framework for data ethics and justice curriculum. We propose three interventions: 1) Integrate data ethics and justice into Program Learning Outcomes (PLOs) using a shared pedagogical framework, 2) Connect ethics education with technical content in sample assignments, and 3) Ensure diversity, inclusivity, and accessibility in these interventions.

The integration of ethics in data science education is vital, acknowledged by consensus across academic and industrial sectors. This consensus underlines ethical reasoning as essential in daily data practices, emphasizing a curriculum that balances technical skills with ethical and just data practices.

However, challenges exist in incorporating ethics into data science education. These include differing views on what constitutes comprehensive data ethics education, instructors' lack of formal ethics training, and difficulties in instructional design and assessment. Additionally, students often struggle to relate ethics to technical content, which is compounded by unclear instructions or limited prior ethics training. These challenges highlight the need for shared educational strategies and resources that effectively bridge the gap between technical expertise and ethical competency.

Through this project, we aim to provide a shared pedagogical approach, conceptual frameworks, and sample assignments based on the value of diversity, inclusivity, and accessibility. This approach will enable instructors to create a cohesive and inclusive educational experience, equipping students with not only technical skills but also the ethical acumen to navigate the complex sociotechnical landscapes of the modern world.

**Synthesize relevant literature with citations that support the proposed enhancement and intended outcomes in the same way you address existing knowledge in any research project in your discipline. Stress recent and comprehensive literature.**

This project aims to enhance DS and MLIS programs by incorporating data ethics and justice competencies, aligning with the academic and industry consensus on ethical problem-solving and responsible data handling (Martin, 1997; NASEM, 2018). Recent reforms in data science education underscore the importance of integrating ethical considerations with technical skills, transitioning from traditional compliance-focused education to a practical, problem-solving approach (Data and Society Research Institute, 2016; Saltz et al., 2019).

Challenges in integrating ethics into DS education include disagreements on what constitutes comprehensive data ethics education, the complexity of ethical issues, and instructors' lack of formal ethics training (Brown et al., 2023). Instructional design also poses challenges, such as a shortage of suitable resources and difficulty in assessing ethical knowledge in technical classes (Fiesler et al., 2021). Students often struggle to connect ethics with technical content due to unclear instructions or limited ethics training (Cohen et al., 2021; Tseng et al., 2022), highlighting the need for shared educational strategies and resources (Smith et al., 2023).

Our project proposes three key interventions: 1) incorporate data ethics and justice competencies into PLOs, 2) connect ethics education with technical content in sample assignments, and 3) ensure diversity, inclusivity, and accessibility in course content and assignments.

The first intervention involves revising the PLOs of DS and MLIS programs using the Data Science Lifecycle Ethos Approach (Boenig-Liptsin et al., 2022), developed and implemented in UC Berkeley's Human Contexts and Ethics program. This approach encourages maintaining ethical practices throughout the data science workflow, from problem framing to result communication, by teaching how to pair ethical reflection with each stage of the lifecycle (Keller et al., 2020). We will construct a Canvas course and create a module to explain the Data Science Ethos Lifecycle and provide a conceptual overview of data ethics and justice.

The second intervention is the development of integrative assignments that align ethical content with technical skills based on the Embedded EthiCS approach used at Stanford (Grosz et al., 2019). This strategy focuses on the development of core curriculum that embed ethical reasoning within specific technical implementations (Brown et al., 2023). Sample assignments will be tested in pilot courses and shared through the Canvas course.

The third intervention is to ensure diversity, inclusivity, and accessibility in Canvas course contents and assignments. We will follow the Columbia Guide for Inclusive Teaching and Learning (2017), focusing on diversity and inclusivity in content and accessibility in instructional design. It aligns with recent trends emphasizing critical and social perspectives in data ethics education (Beaulieu & Leonelli, 2022; Hoffman & Cross, 2021), informed by transdisciplinary knowledge and case studies on inequalities perpetuated by data and AI (Chi et al., 2021; Hicks, 2013; Nelsen, 2017).

By providing an educational foundation that blends technical expertise with critical thinking and ethical decision-making skills, this project will equip students to tackle real-world data science challenges responsibly. Our efforts also align well with Luddy’s Strategic Plan by reflecting its core values of ‘society-centered’ technology and fostering an inclusive campus environment (Luddy Strategic Plan, n.d.).

# Section 4: Project Description (1000 words maximum)

**State measurable project goals that will help you realize the course/curriculum enhancement.**

This project will employ critical frameworks to embed data ethics and justice into DS and MLIS curriculum.

Goal 1: Review and revise PLOs for DS and MLIS to include data ethics and justice competencies, using the Data Science Ethos Lifecycle Approach. We will create a Canvas course with two modules to familiarize instructors with the updated PLOs and foundational ethics concepts. The revised PLOs foster students’ ethical reasoning skills, aligning with current industrial and academic standards.

Goal 2: Create sample assignments using the Embedded EthiCS approach, blending ethical understanding with technical learning. These assignments, provided through the Canvas course, will aid instructors in designing effective learning experiences. Their effectiveness in improving students' ability to apply ethics in practical scenarios will be tested in three pilot courses in Spring 2025.

Goal 3: Ensure diversity, inclusivity, and accessibility in Canvas course content and sample assignments. Following the Guide for Inclusive Teaching at Columbia (2017), we will ensure our materials recognize diversity and adhere to Transparency in Learning and Teaching (TLIT) principles.

These enhancements are expected to improve students’ capabilities in ethical problem-solving and decision-making in data science and library and information science, leading to increased engagement, particularly among students from diverse backgrounds.

**For each project goal, describe the specific activities you will engage in to achieve the goal.**

**Project Goal #1:** Ensure diversity, inclusivity, and accessibility in Canvas course content and sample assignments.

* Study two key principles of inclusive teaching practices suggested in the ‘Columbia Guide for Inclusive Teaching at Columbia’ (2017):
	+ Principle 3 – Diversity and Inclusivity in Content
	+ Principle 4 – Accessibility in Instructional Design
* Curate Canvas course content that encompasses a wide range of perspectives and authors from diverse backgrounds.
* Ensure that all elements of sample assignments are accessible to all students. This involves using multiple means of reducing barriers to learners, respecting different ways of learning, and creating a supportive class climate.
* Integrate Transparency in Learning and Teaching (TILT) principles by providing clear purposes, tasks, and criteria in sample assignments.

**Project Goal #2**: Create sample assignments using the Embedded EthiCS approach, blending ethical understanding with technical learning.

* Pilot Course Selection Criteria: 1) Courses taught by team members; 2) Two DS courses (one technical, one non-technical) and one MLIS course emphasizing data and AI ethics; and 3) Courses to be offered in Spring 2025.
* Planned Pilot Courses:
	+ LIS S304: Social Media Data (Technical), Instructor: Danbi Yoo.
	+ LIS S301: Data Policy and Governance (Non-Technical), Instructor: Angela Murillo.
	+ LIS S553: Public Library Management (Graduate-Level), Instructor: Andrea Copeland.
* Create sample assignments featuring instructions, activities, discussion prompts, and evaluation criteria.
* Develop Module Three in the project's Canvas course for the sample assignments.
* Implement and assess these assignments in pilot courses in Spring 2025.

**Project Goal #3:** Revise the Program Learning Outcomes (PLOs) to include data ethics and justice competencies, using the Data Science Ethos Lifecycle Approach.

To achieve this goal, we will:

* Conduct in-depth review of the current PLOs focusing.
* Study the Data Science Ethos Lifecycle Approach
* Update the PLOs based on the review and study and following the Guidance for Writing and Improving Learning Outcomes Statement (University of Maryland, 2021c).
* Refine and validate the updated PLOs during monthly Data Science Committee Meetings of which all the PIs are member.
* Construct a Canvas course dedicated to this project, and add two modules:
* Module One explains the Data Science Ethos Lifecycle Approach and the revised PLOs.
* Module Two provides a conceptual overview of data ethics and justice.

**Describe a plan for sustainability of the curriculum enhancement beyond CEG project timeline, including references to ongoing professional development, assessment, partnerships, and growth.**

In Summer 2025, we will refine the Canvas course, using evaluation results for guidance. In Fall 2025, we will present our findings at the DS Committee Meeting, advocating for the wider adoption of updated PLOs and piloted assignments in DS courses. DLIS Teaching Culture Discussions, a monthly meeting initiated in Fall 2023, will promote the inclusion of data ethics and justice competencies in more MLIS courses, fostering a collaborative environment for developing integrative and inclusive assignments. Additionally, we will host a faculty meeting at IUI to discuss the benefits of integrating data ethics in enhancing student learning outcomes and engagement.

# Section 5. Evaluation/Assessment Plan (500 words maximum)

**What will success in your CEG project look like?**

Success in this project is characterized by 1) the robust revision of the PLOs to incorporate data ethics and justice competencies, 2) improved students' ethical decision-making skills in pilot courses, and 3) enhanced inclusivity in course content and accessibility in sample assignments.

* 1. **What metrics will you use to determine the extent to which your project goals were achieved?**

**Goal:** Ensure diversity, inclusivity, and accessibility in Canvas course content and sample assignments.

* **Evaluation/Assessment**: Assess the reduction of barriers for inclusion and equity by comparing students’ structured survey responses and scores on difficulties and barriers between past and pilot courses. Analyze Course Evaluation scores for accessibility in past courses and the pilot courses, utilizing responses to questions about course material accessibility and clarity of online resource instructions, which have been default Course Evaluation questions every year. Evaluate content diversity, inclusivity, and assignment accessibility through a consultation with the CTL using adapted criteria from the ‘Guide for Inclusive Teaching at Columbia’ (Columbia Guide).
* **Analysis Method**: Conduct a structured survey in pilot courses in April 2025 and Student Course Evaluations to collect qualitative and quantitative data on students’ experiences with technical and ethical learning barriers in pilot courses compared to past courses. Perform thematic analysis on qualitative data, while conducting statistical analysis on quantitative data. Consult with the CTL in May to assess Canvas course contents and assignments based on the Columbia Guide’s Teaching Strategies.

**Goal:** Create sample assignments using the Embedded EthiCS approach, blending ethical understanding with technical learning.

* **Evaluation/Assessment:** Compare pre-test and post-test scores of students’ ethical problem-solving and decision-making skills and conduct a statistical analysis using data such as average score and individual score differences. Analyze Student Course Evaluation scores in past courses and the pilot courses, especially focusing on responses to the questions about their perceived improvement in critical thinking, subject knowledge, and application in profession, which have been included in the Course Evaluation every year.
* **Analysis Method:** Receive feedback from the external evaluator, the CTL, and the Data Science Committee in Fall 2024 on the instructional design and evaluation method of sample assignments. Conduct thematic analysis of this feedback and revise the assignments accordingly. Implement a pre-test in pilot courses in January 2025 and a post-test in April 2025. Conduct Students Course Evaluation in April 2025.

**Goal:** Revise the Program Learning Outcomes (PLOs) to include data ethics and justice competencies, using the Data Science Ethos Lifecycle Approach.

* **Evaluation/Assessment**: Utilize the four attributes that characterize strong learning outcome statement suggested in the University of Maryland (UMD)’s ‘Learning Outcomes Assessment Guide’ (2021a). Following the ‘Rubric for Review of Undergraduate Program Learning Outcomes’ (2021b) developed by the authors of this guide, and with the help from CTL consultants, we will evaluate the updated PLOs based on clarity, specificity, measurability, and student-focus, using a three-point scale: Exemplary (3pts), Acceptable (2pts), Unsatisfactory (1 pt).
* **Analysis Method**: Regularly engage in the monthly DS and LIS meetings and receive feedback. Consult with the CTL and the external evaluator in August 2024 on the updated PLOs, receive their evaluations by applying the four attributes from the UMD’s Guidance for Writing and Improving Learning Outcomes Statements (2021c). Utilize their scores and feedback to refine PLOs before implementation in pilot courses.

# Section 6. Dissemination Plan (250 words maximum)

We will employ various channels to disseminate our project findings and engage with relevant audiences.

In Fall 2025, we will conduct presentation sessions at the DLIS Teaching Culture Discussion and DS Committee Meeting to share our experiences and insights with DS and MLIS faculty. These sessions are crucial for discussing the advantages of integrative data ethics teaching and its broader application in DS and MLIS courses.

Additionally, the Canvas course containing our pedagogical framework and sample assignments will be refined based on the evaluations (Section 5) and then made available to all faculty members and instructors at IU Indianapolis.

To extend our reach to academic communities across and outside IU campuses, we will present our research on the best practices of teaching ethics in technical courses at the Plater-Moore Conference on Teaching and Learning and the Midwest Conference on the Scholarship of Teaching and Learning (SoTL) in Spring 2026.

For global outreach, we will attend and present at the iConference 2026, an international conference organized by iSchools, featuring information scholars from over 120 universities worldwide.

Further, we intend to submit a reflective journal article to either the Journal of Education for Library and Information Science (JELIS) or the ACM Transactions on Computing Education (TOCE). This article will detail our experience and the practical implications of integrating data ethics and justice into the DS and MLIS curriculum. We will ensure long-term access to these publications by hosting them in ScholarWorks and linking them on the department's website.

# Section 7. Project Timeline (250 words maximum)

**Project Goal 1 (May – September 2024):**

* May: Form research team. Construct a Canvas course for the project. Begin PLOs review.
* June: Study Data Science Ethos Lifecycle; start PLOs update.
* July: Continue PLOs update. Create Module One for Data Ethos Lifecycle and updated PLOs.
* August: Consult with the CTL on updated PLOs. Add Module Two for the conceptual overview of data ethics and justice. Begin research and consultation for sample assignments. Consult with the external evaluator on PLOs and assignments.
* September: Finalize PLOs.

 **Project Goal 2 (September 2024 – April 2025):**

* **Phase 1 (September – December 2024):**

September-November: Design sample assignment for three pilot courses. Monthly refinements from the Data Science Committee feedback.

November: Write the mid-progress project report.

December: Submit the mid-progress project report to the CTL. Consult with the CTL, DS Committee, and the external evaluator to finalize assignments. Design pre- and post-tests.

 **Phase 2 (January 2025 – April 2025):**

January: Implement pre-test. Developed Structured Survey questions for evaluation.

February and March: Create Module Three to house sample assignments and supporting materials.

April: Conduct post-test and structured survey. Administer Students Course Evaluations.

 **Project Goal 3 (May – June 2025):**

* May: Study the Guide for Inclusive Teaching at Columbia and make evaluation criteria for course content and assignments. Consult with the CTL and receive their evaluation. Write the final report.
* June: Analyze evaluations based on qualitative and quantitative data collected from Structured Survey, Student Course Evaluations, and Consultations with the CTL. Revise course content and assignments. Submit the final report.

# Section 8. Budget and Justification

In summary, we are requesting funding in two primary categories: Personnel and Travel. The total cost for Personnel is $xxxxx, which includes stipends for two key team members, benefits, compensation for an external evaluator, and a student assistant. For Travel, we are requesting $xxxx to attend the iConference in 2026.

**Personnel: $20,205**

First, we request funds to support a half month of the PI and one month of one of Co-PI's summer stipends at a total cost of $xxxxx.

Angela P. Murillo: $xxxx (for a half month)

Danbi Yoo: $xxxxx (for one month)

Benefits (29.37%): $xxxx (Yoo) + $xxxx (Murillo) = $xxxxxx

Total= $xxxxx

Secondly, $xxxx is requested to compensate external evaluator Dr. Brandon Sorge in the Technology Leadership and Communication program for three consultation sessions. His expertise in STEM education innovation is crucial for assessing the effectiveness of revised PLOs and sample assignments. We plan to have three sessions with Dr. Sorge in 2024, in August (PLOs), October (sample assignments), and December (pre- and post-test).

External Evaluator: $xxxx ($xxx/session \* 3 times)

Lastly, we request funds to support a student assistant’ hourly work to help the team develop sample assignments. A student assistant will be employed for 210 hours ($xxxx total, at $xxx/hour) from August 2024 to March 2025. The student assistant’s role, requiring skills in data analytics and Artificial Intelligence, is vital for developing technical workflows and integrating tools in sample assignments.

Student Assistant: $xxxx ($xxx/hour x 210 hours (10 hours per week x 21 weeks))

The total fund for personnel is $xxxx ($xxxx for faculty stipend + $xxxxx for an external evaluator + $xxxx for a student assistant).

**Travel: $xxxxx (iConference in Spring 2026)**

We request $xxxx for attending the iConference 2026, anticipated to be held in Europe or Africa. The funds will cover airfare and lodging ($xxxx), registration fees ($xxxx), and meals ($xxxx). This conference is a key platform for presenting our project findings and networking with peers in the field.

iConference 2026: $xxxx = Airfare and lodging $xxx ($xxx of airfare + $xxxx of lodging per team member) + Registration fee $xxxx ($xxxxx per team member) + Meals $xxxx ($xxx per team member for 4-5 days)

The combined total for our project amounts to $xxxx. We are requesting $xxxx from the Grant and the remaining $xxxx will be provided as a Departmental Match.

# Section 10. Results of Previous CEG Funding

The Luddy School of Informatics, Computing, and Engineering, Department of Library and Information Science DLIS has had one previous CEG-funded project. In 2018, three DLIS faculty (Drs. Jones (PI), Murillo (Co-PI), and Yoon (Co-PI)) collaborated on the project, “Towards Quality: A Project to Systematically Develop Quality Matters Skills and Capacities for an Online Department.” For this grant, the three faculty became certified in Quality Matters standards, incorporated these standards into three online undergraduate courses, created a Quality Matters-aligned Canvas course template to incorporate the QM standards into other online courses, and disseminated the template to faculty throughout their department and school. This Quality-Matters Canvas course template saw widespread implementation throughout Luddy-Indianapolis, including undergraduate and graduate programs both within and outside of DLIS.