ASEE AMERICAN SOCIETY FOR ENGINEERING EDUCATION

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Technology and Society: Incorporating ethics, inclusion, and societal understanding into computer and technology and engineering education curriculum design.

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Technology and Society

Incorporating ethics, inclusive belonging for excellence, and societal understanding into computer and technology and engineering education curriculum design

(2025). CoNECD Conference, February 9-11, 2025, San Antonio, TX

Session Outline

- About us
- Part I
  - What and why this matters
  - Understanding terms
- Part II
  - Signature course walkthrough
- Part III
  - Professional development
  - Curricular examples
  - Group Activity

Session Outcomes

Attendees of this presentation will learn to:

- Identify the importance of incorporating ethics, inclusive belonging for excellence, and societal awareness into the STEM curriculum.
- Recognize ways to incorporate the principles and activities into their own practice.

[...] University

[...] University is *[...]* founded in by the *[...]* in *[...]* focused on providing educational opportunities to *[...]* .

Part I

Setting the Stage

Understanding Our Own Beliefs and Values

Audience Poll

Join: PollEv.com/ [...]

Do you believe the computing and engineering fields should be practiced within the framework of an ethical code?

Yes

0%

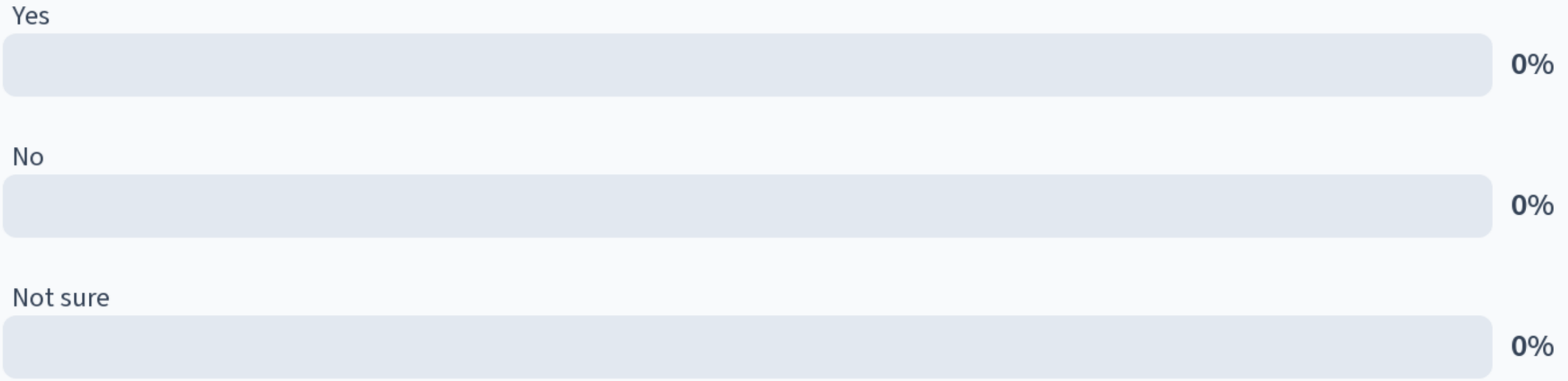
No

0%

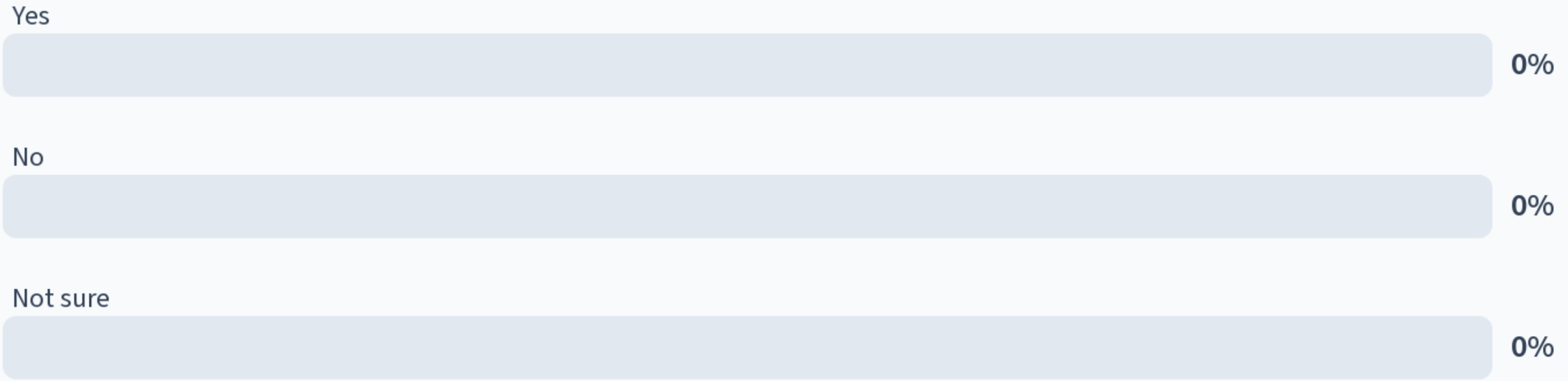
Not Sure

0%

Do you believe computing and engineering disciplines have the power to impact individuals, both positively and negatively?



Do you believe the computing and engineering disciplines hold the potential to influence the future direction of society and the planet—for better or worse



Should students feel able to express themselves respectfully in the classroom?

Yes

No

Not sure

Should students see themselves reflected in the learning materials?

Yes

No

Not sure

Should students have opportunities to engage in meaningful, critical thinking and discussion as part of their coursework?

Yes

No

Not Sure

Do we as educators have a responsibility to prepare students not only as skilled professionals but also as ethical, socially conscious individuals who can positively impact the world as engineers or technologists?

Yes

No

Not sure

Corporate Incentive

Ethical workers who understand and implement social awareness principles can contribute to **more innovative, productive, and equitable workplaces** and **products**, ultimately driving **better business outcomes and societal benefits.**

(Ely & Thomas, 2020; Lorenzo et al, 2018.; Deloitte, 2023; & McKinsey & Company, 2020).

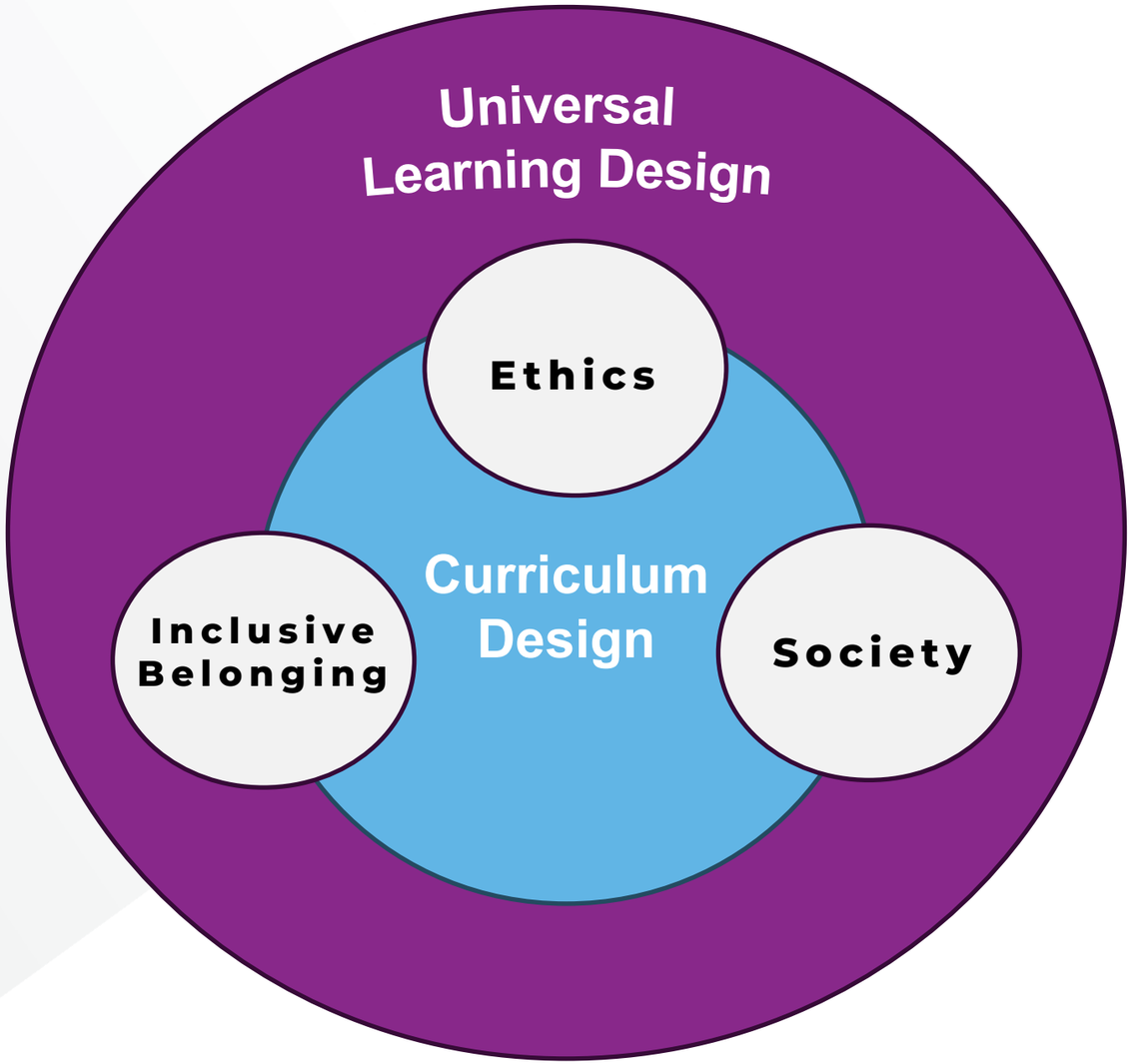
Corporate Ethics

Of companies surveyed have ethical principles governing emerging technologies.

Such a gap in ethics is unacceptable.

(Deloitte, 2023)

The Academy's Responsibility



School of [...]

The School of *[...]* has taken proactive steps to ensure these principles are infused throughout the curriculum, including a signature course experience and purposeful integration and assessment of ethics and inclusive belonging for excellence principles scaffolded throughout degree pathways.

Defining Our Terms

Our Definitions and Connection to the Curriculum

Ethics

Ethics is acting and with integrity and accountability to foster a climate of civility, honesty, and respect. Our ethics are embodied in our Code of Conduct.

Guiding Principles at *[…]*			
1.	Maintaining the Highest Ethical Standards	5.	Respect for each Person
2.	Honesty and Integrity	6.	Academic Integrity
3.	Respect for the Law	7.	Health and Safety
4.	A Culture of Trust	8.	Accurate Recordkeeping

- ABET Ethics Example: The curriculum must include topics related to professional and ethical responsibilities, diversity and inclusion awareness, quality, and continuous improvement.

([…], 2024; ABET, 2024)

Why Ethics Matters in an Education Setting

- Within our STEM curricula, this means we teach to the professional codes of conduct, such as the IEEE and AMC Codes of Ethics, and facilitate discussions on how to apply and uphold these principles in decision-making and professional practice.
- We emphasize the importance of understanding and maintaining ethical standards in every aspect of their work, helping students to navigate complex situations with integrity and accountability.
- By embedding these ethical considerations into our teaching, we prepare students to make informed, responsible choices that reflect their commitment to professionalism and societal impact.

Why Inclusive Belonging for Excellence Matters in an Education Setting

- Goes beyond merely providing access to education.
- Involves actively reducing barriers to understanding the material presented.
- To achieve this, it's essential to consider the unique and varied lived experiences of students.
    - For example, if you're designing a structure to be used in a snowy environment, you might have students who have never experienced snow. How might this affect their comprehension of the material and assignment?
- Modifying the curriculum to support diverse learning backgrounds and lived experiences enhances student understanding and reduces barriers to learning.
- In addition to reducing educational barriers, fostering inclusive belonging means creating an environment where all students feel valued and respected. This involves adapting teaching methods to meet the diverse needs of learners, ensuring that every student, regardless of background or ability, has the support needed to succeed.

Why Inclusive Belonging for Excellence Matters in an Education Setting

In addition to reducing educational barriers, fostering inclusive belonging means creating an environment where all students feel valued and respected. This involves adapting teaching methods to meet the diverse needs of learners, ensuring that every student, regardless of background or ability, has the support needed to succeed.

Practical strategies include:

- Using inclusive language (e.g., saying “Hi, everyone” instead of “Hey, guys”).
- Offering flexible assessment methods that cater to different learning styles (e.g., allowing both written or video submissions).
- Fostering a classroom culture that celebrates diverse lived experiences and encourages peer collaboration.

Why Societal Considerations Matter in an Education Setting

- Societal considerations of the discipline include its potential to affect individuals, the society, and the planet – either positively or negatively.
- We ask students to consider multiple points of view, unintended consequences, and the broader implications of their work
- For example, we ask to students to consider their design from a multiple use perspective, asking what does this design afford or constrain, who is impacted by the choices made, why it matters, and what does it mean to them as well as society more broadly.

Alignment with ABET

Quality Assurance and Continuous Improvement

ABET emphasizes the importance of continuous improvement in educational programs.

Diversity, Equity, and Inclusion (DEI)

ABET encourages educational programs to cultivate a diverse and inclusive learning environment and places emphasis on fostering an inclusive academic community.

Student-Centered Learning

ABET promotes a student-centered approach to education, emphasizing the need to adapt teaching and assessment methods to meet the needs of all learners. ABET expects programs to ensure that their educational offerings are responsive to student needs.

Curricular Innovation

ABET encourages programs to embrace innovative practices that enrich student learning and respond to evolving societal needs, aligning with ABET's commitment to the continuous improvement of educational quality.

(ABET, 2024)

Part II

Signature Course

[...] Technology and Society

- A signature course for all School of [...] Students.
- Required in the first year.
- Examines technological change and its impact on human needs and concerns.
- Ethical and societal dilemmas framing technological change are emphasized.
- Upon completion, students can critically evaluate the implications of technology on society.

Welcome to the course!

In this course, we explore technological change within larger societal contexts.

[...] Technology and Society

[Embed course video]

[Present live walk-through of course in Canvas]

Part III

Professional Development

Professional Development

Instructor and Subject Matter Expert Training

Trainings and Resources

Mandatory PD — All Staff

- Inclusion at **[...]** : Microaggressions and Unconscious Bias
- Inclusion at **[...]** : 9 Skills for Communicating and Collaborating Across Difference
- Ethics for Employees
- Inclusive Communication Unit Discussions

FAC100 — Faculty and SMEs

- Module on Inclusion, Equity, and Diversity in the curriculum
- Vendor led SME orientation includes principles of learning design and best practices in course development

Supplemental PD — SoT Faculty and SMEs

- Supplemental packet for SMEs with expectations, examples, and side-by-side pre/post comparisons
- School of **[...]** Thought Leadership forum

Future PD — SoT Faculty and SMEs

- Intercultural Development Inventory (IDI) and debriefing
- Deep dive workshops (e.g.; discussions, integration rather than tack-on, facilitation for strong start courses)

Side-By-Side

Course Descriptions:

Before and After Considering
Ethics, Inclusive Belonging for Excellence, and Societal Impact

[...] Cloud Networking and Storage Strategies

Before

This course explores networking concepts and storage solutions tailored for cloud environments, focusing on the interdependencies of nation-states and multinational cloud infrastructures. Students examine the intricacies of virtual networks, load balancing, content delivery networks (CDNs), and advanced cloud storage technologies. Emphasizing the optimization of network performance and the effective management of cloud-based storage resources, the course equips students with practical skills for designing, implementing, and maintaining robust cloud networking and storage infrastructures.

After

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[...] Introduction to Energy Utilization

Before

Introduction to current and potential energy sources, the link between energy and wealth, and the consequences of action or inaction concerning energy and the environment.

After

This course explores how supply and demand dynamics shape the energy sector nationally and globally. Students critically examines economic, political, environmental, and social factors influencing technological advancements in energy, highlighting how access to resources and economic volatility impact how individuals and societies value and use energy resources. This systemic analysis provides students with a deep understanding of the multifaceted factors driving energy decisions and their broader implications. Upon completion of this course, students develop the ability to analyze the factors that shape the energy sector nationally and globally, as well as explain how variations in economic, political, environmental, and social factors affect technological advancements related to the production, transmission, and consumption of energy.

[...] Introduction to 3-D Modeling

Before

This introductory engineering graphics course equips students with the skills to create properly dimensioned 2-D sketches and fully dimensioned 3-D parts. Through various projects, students practice creating 3-D models and focus on using and modifying 2-D sketch tools such as line, circle, arcs, rectangle, offset, fillet, chamfer, trim, mirror, move, rotate, copy, scale, stretch, and other commands. They also learn feature commands including extrude, extrude cut, loft, revolve, wrap, helix, swept boss/base (sweep), and hole wizard. Additionally, students build assemblies and produce detailed drawing documentation for manufacturers. The course covers designing mechanical components to master the basics of SOLIDWORKS software.

After

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[...] Robotics and Automation

Before

This course provides a thorough exploration of the principles, technologies, and applications of robotics and automation. Students study the interdisciplinary nature of these fields, gaining a solid understanding of both theoretical foundations and practical implementation aspects. Covering topics from basic robotic mechanisms to advanced automation systems, the course equips students with the knowledge and skills to design, develop, and implement robotic and automated solutions across various industries. The course includes programming, networking, and data communications, offering hands-on experience through a lab component. Students gain practical experience with robotic hardware, industrial automation equipment, and software platforms such as ROS (Robot Operating System) and PLC (Programmable Logic Controller). By the end of the course, students are prepared to tackle challenges in robotics engineering and automation, contributing to advancements in technology and innovation in diverse industrial sectors.

After

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Side-By-Side

Course Content:

Before and After Considering
Ethics, Inclusive Belonging for Excellence, and Societal Impact

Lens Awareness

Questions we ask during design and delivery:

- Who are we including and who are we excluding?
- What does that mean and why does it matter – for the product, for the company, and for society?
- Is the content relatable and meaningful to learners?
- How are we measuring this learning?

Content Considerations:

Ethics

Content Considerations

[...] Strength of Materials

Before

For your first assignment, you will practice solving a simple force problem, utilizing your understanding of mass, weight, Newton’s laws, and fundamental units.

How much does an 8 kg bag of flour weigh? Submit your answer in lbf.

Using equations, calculate the weight of force of the bag in flour. Ensure the answer submitted is in the units of lbf (convert if necessary).

Prompt

To make this assignment more engaging and relevant, it’s important to provide students with context on why solving such problems matters. By offering relatable examples students will better grasp the importance of these calculations. This approach helps bridge the gap between theoretical concepts and real-world applications, making learning more meaningful.

After

Imagine you're at the grocery store, picking up an 8 kg bag of flour. Have you ever thought about what that bag really weighs as a force, and why is it important to understand the concept of weight? not just as "feeling heavy"? This isn't just a math exercise—it's about understanding how weight as a force affects everyday tasks, like carrying groceries or working out. By solving this, you'll learn to convert mass (kg) into weight (lbf), and what that number means to that this skill could lead to eliminating serious miscalculations in engineering, construction, or safety-critical designs.

Content Considerations

[...] Data Structures, Algorithms, and their Societal Impact

Before

Discussion Question

Arrays vs. Lists: Discuss the differences between arrays and lists in terms of implementation, performance, and use cases. When would you choose one over the other?

Prompt

Consider the following:

While both consider the differences in array/list selection, the after helps students think beyond the purely technical and consider other elements of programming choices.

After

As software developers, our choices in data structures and algorithms can have broader social impacts. Consider how the efficiency or scalability of a system that relies on arrays or lists could affect users. For example, how might poor performance or memory issues in an algorithm disproportionately impact certain groups of people (e.g., in healthcare or financial applications)? How could you ensure that the choice of data structure aligns with social responsibility?

Content Considerations:

Inclusive Belonging

Content Considerations

[...] Fundamentals of Programming

Before

Practice writing pseudocode to make a peanut butter and jelly sandwich. Consider how someone would follow this using ONLY the instructions provided in your pseudocode. Remember, computers will only perform as instructed.

Prompt

Not all countries and cultures may be familiar with a PBJ. If this is an activity, I'd allow them to choose their own sandwich or meal item. If this is a description to make a point, consider adding in a photo of a PBJ or put more context around this type of sandwich.

After

Practice writing pseudocode to make a simple recipe. Consider how someone would follow this using ONLY the instructions provided in your pseudocode. In the example below, a peanut butter and jelly sandwich is used, but really any simple recipe can be used for this analogy. Remember, computers will only perform as instructed.

[embedded video of making a PBJ]

Content Considerations

[...] Theory of Computational Ethics

Before

Regular expressions are used to ‘find’ or ‘find and replace’, a common feature in text editors such as Microsoft Word (CTRL+F or or CMD+F.). Regular expressions (regex or regexes) can be used for input validation and human-computer interaction, meaning the user experience (UX) and user interface (UI). For example, the expression gr(a|e)y will find either gray or grey.

Prompt

Consider adding a conversation or textual explanation around cultural differences and the impact it can have on your output (such as in spelling).

After

Regular expressions are used to ‘find’ or ‘find and replace’, a common feature in text editors such as Microsoft Word (CTRL+F or or CMD+F.). Regular expressions (regex or regexes) can be used for input validation and human-computer interaction, meaning the user experience (UX) and user interface (UI). For example, the expression gr(a|e)y will find either gray or grey. Notice the two different spellings of this, which greatly depends on cultural differences. Consider how other cultural differences may impact the output.

Content Considerations

[...] Project Management

Before

Imagine we're tasked with developing a mobile application for a restaurant chain. The app will allow customers to order food for pickup or delivery. To facilitate discussion, we'll explore two popular SDLC approaches: Waterfall and Agile.

Prompt

Access, usage, and level of technological advancement may influence a learner's understanding of this assignment. Is there a video showing the use of a sample mobile restaurant app or two? Reduce the Zone of Proximal Development so learners can focus on the task at hand.

After

Caption: Food delivery app order with phone. Online mobile service for take away burger and pizza. Hungry man reading restaurant menu, website and reviews with smartphone.

Content Considerations

[...] Fundamentals of Programming

Before

Scratch is so simple that even a child can use it.

Prompt

Consider how frustrating this statement may be if the student is struggling in the beginning, and they think "if even a child can do it what's wrong with me?" How might you reframe the learning experience?

After

Scratch provides a fun and engaging way for beginners to learn programming concepts through a user-friendly interface and interactive projects.

Content Considerations

[...] Self-Reliant Language Learning

Before

Students begin their final project this week. Students will select a new programming language to learn and develop a plan to build a small project using that language. As the instructor, encourage students to take a leap of faith as they learn a new language. The following are ways you can support students:...

Prompt

Remove colloquial religious reference so the course is agnostic.

After

Students begin their final project this week. Students will select a new programming language to learn and develop a plan to build a small project using that language. As the instructor, encourage students to believe in themselves as they learn a new language. The following are ways you can support students:...

Content Considerations

[...] Statics

Before

For your first assignment, you will practice solving a simple force problem...

How much does an 8 kg bag of flour weigh? Submit your answer in lbs.

Prompt

Before each problem, provide context that explains why solving it matters and how it relates to real-world applications. In live courses, instructors often make this connection, but in online courses, this element is missing. By adding a brief narrative, students can better relate to the material. Also, will the example of a bag of flour be understandable and relatable to all students?

After

... To give you more context, the average person can comfortably carry around 20-30 pounds in each hand while grocery shopping or handling suitcases. Converting mass to weight isn't just a theoretical exercise—it helps you understand how much force an 8 kg bag of flour (or rice, or cornmeal) exerts in pounds-force, making the math and science behind everyday activities, like lifting groceries or working out, more relatable. This calculation helps us grasp how forces impact everything we interact with in daily life.

Content Considerations: Societal Impact

Content Considerations

[...] : Overview of Computer Security

Before

... The legal and ethical implications of cybersecurity practices, including former U.S. President Biden's Executive Order on Improving the Nation's Cybersecurity, which highlights the importance of collaboration between public and private sectors, will also be covered.

Prompt

Is there a benefit to also exploring, or at least mentioning, other countries' cybersecurity policies? Perhaps cybersecurity policies and discussions in the European Union?

After

The legal and ethical implications of cybersecurity practices, including former U.S. President Biden's Executive Order on Improving the Nation's Cybersecurity, which highlights the importance of collaboration between public and private sectors, will also be covered. Additionally, we will explore **international cybersecurity frameworks**, such as the **European Union's General Data Protection Regulation (GDPR)** and global collaboration efforts aimed at addressing cross-border cyber threats and promoting shared cybersecurity standards.

Content Considerations

[...] Statics

Before

Review the video Hyatt Regency Skywalk Collapse 30th Anniversary failure. This lesson in engineering statics uses this example to show how a simple statics problem was the cause of the tragic event. This video is powerful and will cause you to think on the ethics and responsibility of engineering in regard to public safety.

Prompt

Mention that, unfortunately, this is a common occurrence. Provide a few additional context examples from around the globe - balcony crashes in London, earthquake failures in Türkiye (Turkey), etc.

After

For this discussion post, review the video on the Hyatt Regency Skywalk Collapse, marking the 30th anniversary of the tragic event. This case study in engineering statics highlights how a seemingly simple statics issue led to one of the deadliest structural failures in U.S. history. The video offers a sobering reflection on the ethical responsibilities of engineers, especially concerning public safety. Beyond the Hyatt Regency collapse, consider other global examples: the Rana Plaza factory collapse in Bangladesh, the Morandi Bridge disaster in Italy, balcony collapses in London, and structural failures during earthquakes in Türkiye (Turkey) and Japan. These incidents highlight the global consequences of engineering failures and reinforce the need for diligence in design, construction, and oversight.

Group Activity

Collaborative Problem-Solving:

Integrating Ethics, Inclusive Belonging for Excellence, and Societal Impact in Technology Courses

Group Activity Overview –

Integrating Inclusive Belonging for Excellence, Social, and Ethical in Technology Courses

Objectives:

- Engage participants in a collaborative exercise to integrate inclusive belonging for excellence, social, and ethical considerations into technology courses.
- By the end of the session, participants will have a tangible tool to implement in their courses.

Group Activity –

Collaborative Synthesis and Takeaway

- Groups present their findings and merge them into a unified overview covering all inclusive belonging for excellence, social, and ethical considerations.
- Participants gain a complete understanding of how these elements interconnect to form a well-rounded and ethically responsible course.

Presenter Takeaways

Incorporate Ethics into Curriculum Design

Focus on Inclusive Belonging

Emphasize Societal Awareness

Integrate a Signature Course Early

Utilize Professional Development

Apply a Structured Review Process

Leverage Collaborative Problem-Solving

Thank You

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