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Education for Thriving in a Changing Climate: Curriculum Development for Pre-Licensure and Professional Engineers

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Education for Thriving in a Changing Climate: Curriculum Development for Pre-Licensure and Professional Engineers

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Abstract

Background and Motivation: Addressing the risks of a changing climate requires engineering education to prioritize community resilience and collective action alongside technological solutions. To meet this need, this project develops a foundation of specific, measurable learning outcomes for pre-licensure and licensed professional engineers. This work is critical for fostering civically engaged practitioners who are prepared for community-engaged engineering practice. We directly leverage ongoing discourse from the National Academies of Sciences, Engineering, and Medicine (NASEM) project entitled, "Education for Thriving in a Changing Climate" initiative.

Methodology and Justification: Our unique mixed-methods methodology combines machine processing of high-volume content with expert validation. We utilize a large language model (LLM) (Google Gemini 3.0 Pro) to map core professional engineering resources (e.g., ABET EAC (Engineering Accreditation Commission) criteria, ASCE (American Society of Civil Engineers) Body of Knowledge 3.0, and the Lemelson Engineering for One Planet framework) onto transcripts from four public panels that were part of the NASEM panel work. Expert human review through Human-in-the-Loop confirms LLM mapping (also known as LLM+HitL). Confirmed mapping was then validated using a convenience sample of five Board Certified environmental engineering leaders. Critically, this process defines proposed outcomes not just for professional compliance but for utility in civil deliberation and community-level risk management – as described in The Trust Equation.

Results to Date and Anticipated Impact: The central hypothesis is that integrating defined resilience outcomes into coursework and continuing professional development will significantly improve the management of community-level, socio-technical risks. Initial synthesis has yielded a draft curriculum framework organized around four themes: 1) Systems Thinking and Multidisciplinary Complexity, 2) Sustainability as a Design Constraint and Objective, 3) Ethical Responsibility and Social Context, and 4) Professional Communication and Collaborative Teamwork. We have secured commitments from the American Academy of Environmental Engineers and Scientists (AAEES) to develop and pilot test a module introducing Therapeutic Communication Techniques (TCT) as a tool for engineers to engage effectively with communities, demonstrating a strong commitment to transferability and impact beyond the academic sphere.

Introduction

The escalating climate crisis necessitates a paradigm shift in engineering education, moving from a purely technical focus to one that embraces socio-technical complexity, ethical guardianship, and community resilience. Traditional engineering curricula often treat sustainability as a constraint optimization problem; however, the scope of the climate crisis demands engineers who can act as civic agents capable of co-designing thriving futures with diverse communities. This Work in Progress paper introduces a rigorous methodology for defining specific, measurable learning outcomes for pre-licensure and professional engineers. By synthesizing established professional frameworks with real-time discourse from the National Academies of Sciences, Engineering, and Medicine (NASEM) "Education for Thriving in a Changing Climate" initiative, this project aims to bridge the gap between technical competence and civic responsibility, and future work aims to pilot test a module introducing Therapeutic Communication Techniques (TCT) as a tool for engineers to engage effectively with communities.

Methods

We employed a mixed-methods approach to synthesize high-volume qualitative data into a coherent curriculum framework.

First, we utilized a large language model (Google Gemini 3.0 Pro) to perform a thematic crosswalk. We mapped established professional engineering resources – specifically the current ABET EAC 2025-2026 criteria [1], the Engineering for One Planet (EOP) framework [2], and the ASCE Body of Knowledge (3rd Ed.) [3] – against publicly available transcripts from four public panels convened as part of the ongoing NASEM work on "Education for Thriving in a Changing Climate" [4] [5] [6] [7].

The LLM was prompted to identify convergent themes where professional requirements (e.g., ABET Student Outcomes 2 and 4) intersected with the lived challenges and best practices identified by NASEM panelists.

To verify the results of this automated synthesis with an LLM, a human-in-the-loop (HitL) validation process was manually performed by the author to confirm the thematic mapping against the source texts to ensure contextual accuracy (each suggested theme and all proposed representative quotes were manually verified for accuracy).

To ensure the practical veracity of the identified pillars and to provide expert validation in lieu of student piloting during this development phase, the study participants consisted of five (n=5) Board Certified professional engineering leaders with backgrounds in research, senior practice, and academic administration. These experts provided a critical "practitioner lens" to evaluate the alignment between the draft curriculum and current professional standards, such as the Environmental Engineering Body of Knowledge (EEBOK2) [8].

The validation followed a dual-framework analysis, which included:

1. Baseline-Comparison Analysis: Expert feedback was first measured against the initial thematic baseline generated by the LLM-HitL mapping; and
2. Multivariable Thematic Analysis: Each response was treated as an independent variable to identify a unanimous (5 of 5) consensus on specific curriculum themes versus individual anomalies requiring procedural resolution.

Results

As supported by quotes included in Appendix A and Appendix B, the initial analysis of professional engineering documents and NASEM transcripts revealed four dominant thematic pillars. These pillars bridge the current codified knowledge of the engineering profession with the emergent needs identified by climate education experts.

Theme 1: Systems Thinking and Multidisciplinary Complexity: Current professional standards emphasize moving beyond isolated technical problems to consider complex, interconnected systems. The ASCE Body of Knowledge 3 requires engineers to "analyze complex problems that cross multiple specialty areas," [3] while the EOP Framework asks students to "explain interconnectedness" and "identify dynamic impacts between and among different parts of the system," [2].

This aligns with NASEM panelists who argued against linear models of education. Marika Hecht (Ohio State University) noted that "ecosystems are complex... complex socio-ecological systems," meaning "when we poke in one place, something surprising may happen somewhere else." Similarly, John Wickert (Delaware Dept. of Education) emphasized that "environmental health, economic health, and community health" are inextricably linked.

Theme 2: Sustainability as a Design Constraint and Objective: The documents frame sustainability as a balance of economic, social, and environmental factors integrated into the project lifecycle. ABET criteria require designs to consider "global, cultural, social, environmental, and economic factors," [1] while the EOP Framework tasks engineers with creating solutions that consider "planetary system boundaries," [2].

NASEM participants reinforced this by framing sustainability as an economic and operational logic. John Wickert argued that workforce entrants must be able to "make the economic case for smart environmental choice," while Laura Downey (Kansas Association for Conservation and Environmental Education) highlighted how agricultural education is shifting toward "sustainable and regenerative agriculture" to create "resilient farms."

Theme 3: Ethical Responsibility and Social Context: Engineering standards portray the engineer as a professional with a moral obligation to the public. ASCE BoK 3 states that engineers "have a responsibility to hold paramount the health, safety, and welfare of the public," [3] and the EOP Framework explicitly requires engineers to recognize communities that have been "historically... negatively impacted and/or intentionally marginalized," [2].

This theme was strongly echoed in NASEM discussions. Phil Bell (University of Washington) stated that there is a "foundational ethic that you can't have climate justice without Indigenous leadership and self-determination." Daniel Aldana-Cohen (UC Berkeley) framed success as equity for working-class communities, noting that currently, climate policy often feels "kind of like Whole Foods. Or a Tesla" rather than something accessible to all.

Theme 4: Professional Communication and Collaborative Teamwork: Technical skills are insufficient without leadership and persuasion. ABET requires an ability to "communicate effectively with a range of audiences," [1] and the EOP Framework emphasizes the ability to "sell, pitch, and explain ideas," [2].

NASEM panelists reframed communication as trust-building. John Besley (Michigan State University) argued that the goal is not just to communicate risk, but to help people "see the evidence for making specific decisions in specific contexts." Ruth Kermish-Allen (Maine Math and Science Alliance) noted that effective collaboration "doesn't just happen," but requires intensive scaffolding in professional development.

The results of the initial analysis of the three engineering documents [1] [2] [3] are presented in four themes, each supported by at least two source quotes (Appendix A). The transcripts of the NASEM panel discussions [4] [5] [6] [7] were analyzed to identify the presence of these four themes, as supported by at least two representative source quotes from the transcripts (Appendix B). Collectively, these results point to four dominant pillars that bridge the current knowledge, skills, and attitudes of engineers with the emergent needs discussed by the NASEM panelists. In the discussion section, these four dominant pillars are presented as the basis for our draft curriculum framework.

The results from five (n=5) experts with Board Certification in environmental engineering provide strong validation of the four thematic pillars, with several key amplifications noted for final curriculum deployment. In particular, using the lens of the EEBOK2 [8], all five experts confirmed the shift from compliance-centered approach to an approach focused on both planetary health and human thriving, a view consistent with the emergent framework of "Environmental Engineering 3.0" [9]. In addition, there was strong convergence (5 of 5 experts) emphasizing that technical communication should be reframed as a mechanism for trust building at the community scale (i.e., as part of science diplomacy at the global scale).

Among the expert response, two areas for improvement were identified. First, a point of clarification was offered for Theme 2 (Sustainability as a Design Constraint and Objective). Experts with extensive backgrounds in risk assessment argued that sustainability literacy is a baseline requirement but insufficient for professional practice. To move beyond awareness, these experts proposed emphasizing quantitative competence in probabilistic risk analysis to ensure the curriculum meets accreditation rigor. Second, a concern of assessment was noted for all four themes. Specifically, experts with significant academic experience observed that measuring outcomes such as "trust" with existing instruments such as "Bloom's taxonomy" may be problematic for individual instructors and the sharing of normative rubrics among instructions – perhaps even as part of an updated Body of Knowledge – may ensure adequate assessment of student attainment.

Discussion

The four pillars identified from the thematic analysis of the three engineering documents, verified against the NASEM panel discussions, and considered by Board Certified environmental engineers were used to form the basis for a draft curriculum framework presented in Table 1.

Table 1. Curriculum framework draft mapped to pillars identified and verified through thematic analysis and expert assessment.

#	Pillar	Curriculum framework draft
1	Systems Thinking and Multidisciplinary Complexity	Technical solutions cannot be decoupled from community health and economic systems. The curriculum must teach engineers to model these interdependencies.
2	Sustainability as a Design Constraint and Objective	Sustainability must shift from a metric to a fundamental operational logic. Engineers must be able to articulate the economic and operational value of resilient design.
3	Ethical Responsibility and Social Context	Engineering ethics must evolve from compliance to active guardianship. Curricula must include training on co-designing with marginalized communities and respecting Indigenous sovereignty.
4	Professional Communication and Collaborative Teamwork	Technical communication is reframed as trust-building. Engineers must be trained not just to present data, but to scaffold collaboration and guide behavioral decision-making in the face of risk.

The alignment between the aspirational goals of the NASEM panelists [4] [5] [6] [7], the codified standards of ABET [1], the aspiration of the ASCE Body of Knowledge [3], and the emergent, transdisciplinary framework provided by the EOP [2] suggests that the engineering profession is primed for this curricular evolution. However, a gap remains between the definition of these outcomes and their implementation in engineering programs. By mapping "thriving" – a concept often viewed as abstract – onto concrete professional competencies in systems thinking, sustainability, ethics, and communication, this framework provides a practical roadmap for educators. It challenges the field of engineering to treat community trust-building not as a "soft skill" or a hurdle to be overcome on the path to a technical solution, but rather as part of rigorous engineering design essential for project success in a changing climate.

The reframing of professional communication as trust-building draws on The Trust Equation [10], which formalizes trust as the sum of credibility, reliability, and intimacy divided by self-orientation (T=(C+R+I)/S). We expect this approach to be useful in teaching because it shows that trust is measurable and teachable; credibility corresponds to technical expertise already embedded in engineering curricula; reliability is created through regular community partnerships; and intimacy is directly linked to the paramountcy of health, safety, and welfare of the public - echoing ASCE's foundational ethical standard [3]. Reduced self-orientation requires engineers to adjust the balance among their preference for their own solution as compared to their acceptance of a community-driven design.

For the forthcoming pilot curriculum with the American Academy of Environmental Engineers and Scientists (AAEES), the four evidence-based themes (Table 1) will be operationalized under the working labels Socio-Technical Systems Modeling, Climate Risk Literacy, Community-Based Participatory Design, and Policy Engagement and Trust Building. This terminology is proposed to align with professional-society conventions for continuing-education modules. The pilot program is being developed and will be tested to explore Therapeutic Communication

Techniques (TCT) as a tool for engineers. Examples of specific skills that will be incorporated into this one-hour long module, include:

1. Active listening through the SOLER technique – sitting squarely, open posture, leaning forward, eye contact, and relaxing;
2. Humble inquiry – using open-ended questions to understand rather than interrogate;
3. Mirroring – information, tone, and feelings (i.e., "It sounds like you felt excited when…");
4. Jargon-free communication – recording and post conversation analysis to identify the use of and work with intention to remove excessive technical jargon from communication with non-technical community members; and
5. Constructive feedback – focusing on "coaching", which includes offering suggestions and asking reflective questions to center "the why" (in addition to the who, what, where, when, and how).

We propose TCT to operationalize aspects of The Trust Equation, including: active listening and humble inquiry to build intimacy, jargon-free communication to support credibility across audiences, and constructive feedback practices to reduce self-orientation by centering "the why" of the other party.

A future article will report on the further development, pilot testing, student evaluation, and module assessment in partnership with the AAEES.

Limitations

This study relies upon an LLM-HitL approach to evaluate highly similar documents, including the ASCE BoK, ABET EAC, and the Lemelson EOP. It may not be surprising that the results of the thematic analysis of these documents coalesce around emergent themes in engineering.

Furthermore, this study relies on transcripts from a limited number of public NASEM meetings, which, while extensive, represent a specific subset of expert voices and may not capture the full breadth of global contexts of education for thriving in a changing climate.

Finally, expert feedback from a limited number (n=5) Board Certified environmental engineers – especially a convenience sample – may reflect bias in the personal network of the author rather than true breadth of professional practice.

Conclusion

This project establishes a data-driven foundation for a "Thriving in a Changing Climate" curriculum. The four identified themes – Systems Thinking, Sustainability, Ethical Responsibility, and Professional Communication – offer a scaffold for training engineers who are not only technically proficient but civically essential. Verification from Board Certified environmental engineering leaders supports the veracity of this outcome and provides specific items that may be deployed in pilot modules for pre-licensure and continuing professional development by professional societies.

In particular, trust-building in expert-community communication — formalized through The Trust Equation and operationalized via Therapeutic Communication Techniques — was highlighted as a specific pilot module to be explored with AAEES.

Artificial Intelligence

Consistent with the recommendation of transparency, accountability, and verifiability (as described in [11]), Google Gemini 3.0 Pro was used to perform a thematic crosswalk of multiple sources. The specific prompt included, "Assume expertise in thematic analysis. Perform a thematic crosswalk to identify three to five convergent themes in two distinct sets of input texts. While all sources originate from experts, the rank order of standing follows the sequence: ABET EAC criteria, ASCE BoK, EOP framework, and equal ranking to all NASEM content (unedited transcripts extracted from Zoom recordings). For each theme, provide a title and description and a minimum of two, verbatim quotes for consideration as supporting evidence. Perform a self-check to confirm no hallucinations." As described in the methods, these initial LLM-generated results were examined by humans for approval.

A subsequent prompt was used to confirm the human approved results. The specific prompt included, "Assume expertise in thematic analysis and manuscript editing. Confirm the veracity of the results presented in the attached final manuscript against the results from the following prompt using the additional attached documents. *** prompt: Assume expertise in thematic analysis. Perform a thematic crosswalk to identify three to five convergent themes in two distinct sets of input texts. While all sources originate from experts, the rank order of standing follows the sequence: ABET EAC criteria, ASCE BoK, EOP framework, and equal ranking to all NASEM content (unedited transcripts extracted from Zoom recordings). For each theme, provide a title and description and a minimum of two, verbatim quotes for consideration as supporting evidence. Perform a self-check to confirm no hallucinations." These LLM-generated results were examined by humans for approval.

Subsequently, Claude Opus 4.7 was used to evaluate the near final draft of the manuscript. The specific prompt included: "Assume you are a program chair for the annual meeting of the American Society for Engineering Education. Evaluate the near final draft of the manuscript being submitted by corresponding author Professor Daniel Oerther of the Missouri University of Science and Technology (attached) and offer specific recommendations to improve the manuscript given the following: 1) instructions to authors for the meeting as originally published by ASEE (attached); 2) call for papers as originally published by ASEE (attached); 3) feedback from reviewers and program chair on the original abstract and subsequent draft versions of the manuscript." The author reviewed the feedback from Claude, the author edited the final version of the manuscript, and the author takes full responsibility for the manuscript.

Author approved TL;DR (as recommended by [12]): An LLM-assisted thematic crosswalk with expert validation (n=5) identified four convergent themes — systems thinking, sustainability, ethical responsibility, and communication — scaffolding a draft climate-resilience curriculum and a forthcoming AAEES pilot module on Therapeutic Communication Techniques.

References

[1] ABET, *Criteria for Accrediting Engineering Programs: 2025-2026*, Baltimore, MD, USA, 2024.

[2] Lemelson Foundation, *The Engineering for One Planet Framework: Essential Sustainability-focused Learning Outcomes for Engineering Education*, Portland, OR, USA, 2022

[3] ASCE, *Civil Engineering Body of Knowledge: Preparing the Future Civil Engineer* (3rd ed.), Reston, VA, USA, 2019

[4] NASEM, "Education for Thriving in a Changing Climate, Committee Meeting #3 and Workshop: September 8, 2025," Washington, DC, USA, 2025.

[5] NASEM, "Education for Thriving in a Changing Climate, Committee Meeting #3 and Workshop: September 9, 2025," Washington, DC, USA, 2025.

[6] NASEM, "Education for Thriving in a Changing Climate, Committee Meeting #4 and Workshop: November 7, 2025," Washington, DC, USA, 2025.

[7] NASEM, "Education for Thriving in a Changing Climate, Committee Meeting #4 and Workshop: November 10, 2025," Washington, DC, USA, 2025.

[8] AAEES, *Environmental Engineering Body of Knowledge: Preparing the Future Environmental Engineer* (2nd ed.), Annapolis, MD, USA, 2025.

[9] D.B. Oerther, S. Oerther, and L.A. McCauley, "Environmental Engineering 3.0: Faced with Planetary Problems, Solutions Must Scale-up Caring," *Journal of Environmental Engineering*, vol. 150, no. 9, article 02524001, 2024. doi: 10.1061/JOEEDU.EEENG-7764.

[10] D.H. Maister, C.H. Green, and R.M. Galford, *The Trusted Advisor*. New York, NY: Free Press, 2000.

[11] S. Oerther, and D.B. Oerther, "The importance of transparency, accountability, and verifiability when using artificial intelligence in nursing education," *Nurse Education in Practice*, 2026. doi: 10.1016/j.nepr.2025.104557.

[12] S. Oerther, and D.B. Oerther, "Every publication needs an author verified TL;DR statement," *Nurse Education in Practice*, 2026. doi: 10.1016/j.nepr.2025.104674.

Appendix A Quotes supporting the four themes identified in three engineering documents, including:

- ABET, Criteria for Accrediting Engineering Programs: 2025-2026, Baltimore, MD, USA, 2024
- ASCE, Civil Engineering Body of Knowledge: Preparing the Future Civil Engineer (3rd ed.), Reston, VA, USA, 2019
- Lemelson Foundation, The Engineering for One Planet Framework: Essential Sustainability-focused Learning Outcomes for Engineering Education, Portland, OR, USA, 2022

Theme 1: Systems thinking and multidisciplinary complexity emphasizes the importance of moving beyond engineers solving isolated technical problems, and instead, engineers considering how a specific engineering project interacts with complex, interconnected global, social, and environmental systems. Representative quotes:

- "Analyze complex problems that cross multiple specialty areas appropriate to the practice of civil engineering." (ASCE BoK 3)
- "Analyze the sustainable performance of complex civil engineering projects from a systems perspective." (ASCE BoK 3)
- "Complex engineering problems include one or more of the following characteristics: involving wide-ranging or conflicting technical issues... involving diverse groups of stakeholders... involving multiple disciplines or having significant consequences in a range of contexts." (ABET EAC criteria)
- "Student outcomes... [include] an ability to identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics." (ABET EAC criteria)
- "Explain interconnectedness (e.g., intersecting, related and/or connected systems; human actions and global environmental and social impacts and consequences; synergies and rebound effects) and how all human-made designs and activities rely upon and are embedded within ecological and social systems." (Lemelson EoP Framework)
- "Identify dynamic impacts between and among different parts of the system (i.e., social, environmental, and economic considerations)." (Lemelson EoP Framework)

Theme 2: Sustainability as a design constraint and objective that balances economic, social, and environmental factors (i.e., the "triple bottom line") as integrated into the lifecycle of every project moving establishing a future without waste (i.e., cradle to cradle). Representative quotes:

- "Sustainability for civil engineers is defined as 'a set of economic, environmental and social conditions in which all of society has the capacity and opportunity to maintain and improve its quality of life indefinitely without degrading the quantity, quality, or the availability of economic, environmental and social resources.'" (ASCE BoK 3)
- "Integrate a commitment to sustainability principles into the practice of civil engineering." (ASCE BoK 3)

- "an ability to apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors." (ABET EAC criteria)
- "[Civil Engineering] curriculum must include... principles of sustainability, risk, and resilience to civil engineering problems." (ABET EAC criteria)
- "Create solutions that consider the scale of the activity relative to the planetary system boundaries (i.e., carrying capacities)." (Lemelson EoP Framework)
- "Execute technical analyses to choose strategies that maximize the positive and minimize the negative environmental and social impacts in order to achieve design goals." (Lemelson EoP Framework)

Theme 3: Ethical responsibility and social context portraying engineers are more than technical experts; rather professionals with a moral obligation to protect health, safety, welfare of the public and planet, with an explicit emphasis of protecting the vulnerable and historically marginalized. Representative quotes:

- "Civil engineers have a privileged position in society and have a responsibility to hold paramount the health, safety, and welfare of the public." (ASCE BoK 3)
- "Develop courses of action to ethical dilemmas in complex situations." (ASCE BoK 3)
- "an ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts." (ABET EAC criteria)
- "[Civil Engineering] curriculum must include... application of… an engineering code of ethics to ethical dilemmas." (ABET EAC criteria)
- "Recognize that some communities (e.g. communities of color, rural communities, etc.) have historically been negatively impacted and/or intentionally marginalized and continue to be disproportionately negatively impacted by engineering activities." (Lemelson EoP Framework)
- "Critique complex ethical and values-based choices, employing empathy when evaluating conflicts of interest, trade-offs, and uncertain knowledge and contradictions within problem constraints." (Lemelson EoP Framework)

Theme 4: Professional communication and collaborative teamwork among professionals as well as with the public requires leadership, persuasion, and the ability to navigate complex group dynamics. Representative quotes:

- "Integrate different forms of effective and persuasive communication to technical and nontechnical audiences." (ASCE BoK 3)
- "Integrate concepts and principles of effective teamwork and leadership, including diversity and inclusion, into the solutions of civil engineering problems." (ASCE BoK 3)
- "an ability to communicate effectively with a range of audiences." (ABET EAC criteria)
- "an ability to function effectively on a team whose members together provide leadership, create a collaborative environment, establish goals, plan tasks, and meet objectives." (ABET EAC criteria)
- "Communicate through audience-specific written, graphic/visual, oral, and interpersonal communication skills... [and] Demonstrate ability to sell, pitch, and explain ideas and advance learning." (Lemelson EoP Framework)

- “Demonstrate ability to work within and function well on teams and across disciplines.” (Lemelson EoP Framework)

Appendix B Quotes from NASEM panelists from four panels mapped to the four themes identified in three engineering documents (described in Appendix A).

Details of NASEM panels, include:

- Available online at: https://vimeo.com/1119575041
- NASEM, "Education for Thriving in a Changing Climate, Committee Meeting #3 and Workshop: September 8, 2025," Washington, DC, USA, 2025.
    - Panel 1: Learning Ecosystems for Thriving in a Changing Climate
        - Claire Anderson, Executive Director and Co-founder, Ripple Effect Water Literacy Project
        - Marijke Hecht, Assistant Professor of Environmental Education, Ohio State University
        - Mark Lee, Senior Vice President for Academic Affairs, Spelman College
        - Kal Mannis, Senior Director for Rural Engagement, Arizona Science Center
    - Panel 2: Work-based Learning Experiences for Thriving in a Changing Climate
        - Madeleine Chaisson, Senior Manager, Jobs for the Future
        - Andrés Henríquez, Director of STEM Education Strategy, EDC
        - Christina Kwauk, Research Director, Unbounded Associates
        - Jon Wickert, CTE Director, Delaware Department of Education
- NASEM, "Education for Thriving in a Changing Climate, Committee Meeting #3 and Workshop: September 9, 2025," Washington, DC, USA, 2025.
    - Panel 3: State Policies Related to Education for Thriving in a Changing Climate
        - Sarah Bodor, Senior Director of Capacity Building, North American Association for Environmental Education (NAAEE)
        - Jenn Brousseau, Assistant Professor, School of Marine and Environmental Programs, University of New England
        - Laura Downey, Executive Director at Kansas Association for Conservation and Environmental Education
        - Katie Navin, Executive Director, Colorado Alliance for Environmental Education
    - Panel 4: Economic Considerations for Thriving in a Changing Climate
        - Daniel Aldana Cohen, Assistant Professor of Sociology, UC Berkeley
        - Pushpam Kumar, Chief Environmental Economist UN Environmental Programme
        - Meghan Millea, Professor of Economics, East Carolina University
        - Renata Rimšaitė, Senior Program Manager, University of Nebraska Daugherty Water for Food Global Institute
- Available online at: https://vimeo.com/1154358321

- NASEM, “Education for Thriving in a Changing Climate, Committee Meeting #3 and Workshop: November 7, 2025,” Washington, DC, USA, 2025.
    - Panel: International Climate Change Education Work
        - Radhika Iyengar, Associate Research Scholar, Columbia University
        - Mario Piacentini, Senior Analyst, OECD
        - Ingrid Sanchez-Tapia, Senior Education & Climate-Resilience Strategist, UNICEF
- NASEM, “Education for Thriving in a Changing Climate, Committee Meeting #3 and Workshop: November 10, 2025,” Washington, DC, USA, 2025.
    - Panel: Communicating About Divisive Topics
        - Jenny Benz, Acting Director, NORC Center for Public Affairs
        - John Besley, Michigan State University
        - Teresa Cavazos Cohn, University of New Hampshire

Theme 1: Systems thinking and multidisciplinary complexity; quotes from NASEM transcripts, include:

- “We do really recognize in Delaware There is a direct connection between environmental health, economic health, and community health. ... If you don't have a healthy population, they don't show up to work, you have increased healthcare costs, we really wanted to look at this Challenge holistically.” John Wickert (Delaware Dept. of Education)
- “Ecosystems are complex, right? They're not complicated structures. These are complex socio-ecological systems. ... Which means that when we do one thing, when we poke in one place, something surprising may happen somewhere else that we are not yet prepared for.” Marika Hecht (Ohio State University)

Theme 2: Sustainability as a design constraint and objective; quotes from NASEM transcripts, include:

- “So our students need to be able to make the economic case For smart environmental choice. It's kind of what it comes down to.” ”What if we pushed on more of the producer side and said, look. Our workers are the ones that are at these companies helping make these decisions... What if we had a more environmentally literate workforce? So that what decisions were being made on the business side were a little more pro-environment.” John Wickert (Delaware Dept. of Education)
- “Education is taking place around sustainable and regenerative agriculture. Like using, um, strategies to improve soil health, like cover crops, or reducing inputs. ... These not only create more resilient farms, but they also help to mitigate climate.” Laura Downey (Kansas Association for Conservation and Environmental Education)

Theme 3: Ethical responsibility and social context; quotes from NASEM transcripts, include:

- “I attended the webinar that you all had in July, and Dr. Megan Bang mentioned this foundational ethic that you can't have climate justice Without Indigenous leadership and self-determination, and we have held that same ethic throughout the work.” Phil Bell (University of Washington)
- “We'll know that we are succeeding, I think, when Poor and working class communities... hear words like climate policy or green investment and think That's for me. And I think right now, it's probably a bit more like... that's kind of like Whole Foods. Or a Tesla.” Daniel Aldana-Cohen (UC Berkeley)

Theme 4: Professional communication and collaborative teamwork; quotes from NASEM transcripts, include:

- “[The goal of risk communication is] helping people see the evidence for making specific decisions in specific contexts … The goal of risk communication is not to communicate risk. It's in the context of risks... What are some of the behaviors we want to do? “ John Besley (Michigan State University)
- “fostering collaboration between the school and community. And that doesn't just happen. We really had to scaffold that Pretty intensively in how we design the professional development, how we supported the educators throughout the entirety of the school year.” Ruth Kermish-Allen (Maine Math and Science Alliance)