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Executive Summary

Workshop Purpose and Structure

On March 11–12, 2025, the U.S. National Science Foundation hosted a workshop on Building Educational Capacity in Artificial Intelligence (AI) Across Disciplines with the goal of gathering insights on approaches to building such educational capacity at U.S. institutions of higher education (IHEs). The workshop convened 18 faculty members and administrators from IHEs across the United States to share experiences and insights about existing programs, to help elucidate enablers and barriers for their establishment and sustainment, and to come up with new ideas for building capacity. Participants were drawn from multiple disciplines and institution types. This report summarizes workshop discussions as documented by facilitators, with a focus on points whose consideration might help inform IHEs or funding entities seeking to build capacity in AI education across disciplines at institutions across the United States.

Motivations for Building Educational Capacity in AI Across Disciplines

In general, the value of interdisciplinary AI education varies by field, institution, faculty, workforce, and student interest. The drive for creating interdisciplinary AI educational programs and activities can come from the top down (as initiatives of funding organizations or IHE administrators) or bottom up (student demand or faculty interest). Examples of views expressed include:

- AI literacy is a core capability in today's society.
- Technical AI skills are critical for student workforce readiness.
- IHEs offering interdisciplinary AI programs may be more competitive in attracting students and funding.
- AI can be used to enrich a student's education in another field.
- AI can be a tool to advance knowledge in other fields.
- Experience applying AI in a given domain can help students understand how to use AI responsibly to find optimal real-world solutions.
- AI experts with experience applying AI to a particular domain are more attractive to employers than those without it.

Approaches to AI Education Across Disciplines

Workshop participants described a variety of approaches to AI education across disciplines that have been established or could be leveraged in the near term. Interdisciplinary degree programs aim to integrate AI learning with that of another discipline, generally referred to as "X," in ways that enhance learning in both fields. Such programs are variously referred to as AI + X, X + AI, and AI for X. Participants did not specify a standard format for such programs, instead identifying value in different models to meet different educational priorities and contexts, with some pushing for more of an emphasis on AI fundamentals and theory and others for a focus on AI applications. One participant suggested that a truly interdisciplinary degree should put equal weight on the technical aspects of AI and of X. Many participants suggested that the balance of program content can be treated as a continuum, with the breadth or depth focused more on AI or X, depending on institutional, departmental, and student priorities. Some proposed that, because AI technologies have applications and implications across domains, AI + X could apply to any discipline; others suggested that it could be challenging to integrate AI into certain disciplines.

Another approach to designing interdisciplinary AI programs could be to offer customized courses of study for traditional X or AI programs to emphasize AI or X. This could be done by defining specific "tracks" or "threads" through selection of elective courses tailored to X or AI, or through deliberate incorporation of X or AI case studies or project-based learning within core AI or X classes.

Students could also augment their traditional degree program with AI-related elective courses, capstone projects, certificates, or minors in other fields of study, or through participation in experiential learning, extracurricular clubs, internships, hackathons, research fellowships, or student interest groups—if these options are available at their IHE.

Enablers, Barriers, and Strategies

A key point that arose in the workshop is that IHEs can begin by leveraging the resources already at their disposal, including their unique strengths as an institution, in any capacity-building efforts. Student interest and skills, faculty expertise and bandwidth, funding, infrastructure, institutional characteristics, and partnerships are key resources that can either be enabling or pose barriers, some in ways that may be general to any capacity-building effort and some that are AI-specific.

Students

Participants described their efforts to recruit students and advertise their programs, including through student ambassadors, social media, advertisements, presentations to new enrollees, high-school events, or "road shows." For interdisciplinary programs, such efforts can be collaborations across departments or colleges, highlight the value of AI for X (and vice versa), and make students aware of educational opportunities or pathways. Student scholarships, fellowships, or traineeships to support study of AI make an important difference. Students that lack necessary competencies could be supported through dedicated tutors or clinics or by reducing the prerequisites necessary for some AI courses. Improving student preparation at the K-12 level could also help, including awareness and mitigation of concerns related to the accuracy of AI model outputs or dependency of students on AI tools.

Student interest drives demand for AI educational programs. Positive undergraduate experiences with AI may increase the odds of further engagement at the graduate level, and positive outcomes for graduates can help to recruit new students. Students can also play an important role as research or teaching assistants, or peer mentors or tutors. Barriers to student engagement include uncertainty about what or whether AI skills are workforce-relevant, or gaps in the skills or knowledge necessary to engage in AI educational offerings. Active recruitment and opportunities to fill knowledge gaps through tutoring or clinics are potential solutions.

Faculty

Faculty with necessary core or interdisciplinary AI expertise are also critical, especially given competition with other IHEs and with the private sector. Participants discussed proactive recruitment, efforts to reduce the salary gap with industry, upskilling existing faculty, and communicating to graduate students the quality of life in an academic career to increase their interest in becoming faculty. Potential strategies for securing needed faculty include making funding available for faculty lines; leveraging visiting professorships for industry experts, teaching and adjunct faculty, and teaching assistants; providing sufficient administrative support to faculty; and incentivizing AI education or infrastructure contributions and interdisciplinary scholarship in tenure review. Motivated individual faculty members can also independently incorporate AI into their courses or programs.

Funding

Funding for research and educational programs is also an important resource. Pursuing government and nongovernment funding, including through partnerships with industry, and funding available for IHE leadership priorities were discussed. Maintaining flexibility in finding funding can be a helpful strategy, especially if the funding landscape changes. Building institutional support for capacity building is another approach, including by discussing programs, opportunities, and the potential impact of AI in a fun way, as well as by bolstering support and enthusiasm among colleagues in other disciplines, and engaging the board of regents or other IHE governance whenever possible. Participants also noted that institutional status and reputation can help to attract resources.

The private sector could also partner to provide funding, such as for endowed faculty positions, or support their own experts' participation as visiting IHE faculty. They might also provide in-kind resources, such as domain-relevant data or internship opportunities.

Funding cuts, disruptions, or uncertainty, and the interdisciplinary nature of AI can impede IHE capacity-building efforts. Fluctuations in international student enrollment could affect the sustainability of programs, especially master's programs, due to the tuition revenue from this cohort.

Institutional Characteristics

Participants suggested that flexible or AI-knowledgeable IHE administrators and streamlined administrative processes can be enabling. Some administrators, especially those facing budget constraints, may be reluctant to invest in AI educational capacity building, but educating administrators about the potential value of AI education could help. IHEs located near or with connections to companies that wish to leverage AI in their industry or recruit AI-skilled graduates could collaborate with them to facilitate student projects or research. IHEs could also partner more broadly within their local communities to attract AI-interested traditional and nontraditional students, although communities with limited resources or low interest in AI might present limited partnership opportunities.

IHEs with a history and culture of interdisciplinary education and collaboration may be better positioned than those whose departments do not collaborate. Public IHEs may face hurdles in the form of State educational approvement requirements or constraints on new programs.

Infrastructure

Technical and curricular resources identified included computing capacity, including graphics processing units and high-performance computing, data for model training, and sandboxes or enterprise licenses that protect data when using commercial AI models. Such resources can be obtained via partnerships or donations, which may come with complicated intellectual property protection clauses. Alternatively, campuses may already have or can either establish such resources on-site or leverage those available from other sources, for example through the National AI Research Resource (NAIRR) Classroom resource. Curricular resources could be developed for or shared among IHEs.

Near-Term Actions and Visions for the Future

At the end of the second day of the workshop, participants shared ideas for actions to start building capacity now. They suggested initiating discussion within their IHEs, for example, by sharing takeaways from the workshop, convening new workshops, drafting proposals for new educational programs or activities, giving short presentations, or brainstorming benefits and ways of incorporating AI into their discipline at the department level. They also talked about leveraging their IHE's existing strengths and engaging with colleagues from other disciplines to explore opportunities, seed enthusiasm, and begin designing and implementing interdisciplinary experiences. Instituting new mentorship mechanisms—for both faculty and students—and advisory boards could also facilitate this process. Participants also saw opportunities to incentivize infrastructure development and data sharing, develop new funding mechanisms or programs for capacity building, and create a repository of educational resources. Engaging with potential partners across sectors can also be pursued, along with new recruitment mechanisms.

Participants were also asked to share their visions for the future of AI education across disciplines. Many envisioned interdisciplinary AI education at all IHEs, with AI helping to address real problems. Some suggested that all individuals will have the opportunity to learn and use responsible AI in their own context, to the degree they find valuable. This vision could be enabled by broader preparation for students at the K-12 level. Participants speculated about whether AI will become broadly integrated into other disciplines, as a helpful tool analogous to mathematics, such that all education in X becomes X + AI. Finally, several suggested that AI will shape the future job market, and that the United States must be prepared.

Conclusions

Faculty or administrators interested in advancing AI educational capacity at IHEs can initiate conversations within their department or with IHE leadership to explore objectives and mechanisms most suited to their existing missions and priorities, including the models presented in this report. Policymakers and funders could consider enablers in this report and engage further with IHEs and other experts. While it is unclear how AI will be integrated into education across disciplines and IHEs in the longer-term, the workshop discussions offered ideas for near-term opportunities for building capacity and made connections across disciplines.

Contents

1. Introduction: Workshop Background and Purpose

The U.S. National Science Foundation (NSF) hosted the Workshop on Building Educational Capacity in Artificial Intelligence (AI) Across Disciplines at its headquarters in Alexandria, Virginia on March 11–12, 2025, facilitated by researchers from the IDA Science and Technology Policy Institute (STPI). The objective of the workshop was to help participants and NSF observers glean insights from faculty and administrators at a variety of U.S. Institutions of Higher Education (IHEs) about approaches to increasing educational capacity in AI across disciplines relevant to government agency missions.[1] It was also designed to help stimulate community building among individuals who implemented—or who aim to implement—new approaches to capacity building at their IHE. The full agenda is provided in Appendix A, and prompts used to stimulate discussions are provided in Appendix B. Of particular interest were identification of:

- Enablers for designing and implementing AI educational programs and activities across disciplines (that is, in fields other than AI, sometimes referred to generally as "X").
- Barriers and challenges experienced, and lessons learned, in designing and implementing AI educational programs and activities across disciplines.

Sessions were discussion-based and driven by 18 expert participants, whose biographies are provided in Appendix C. A variety of programs were represented, including interdisciplinary or applied AI degrees, with non-AI disciplines including such fields as cybersecurity, agriculture, engineering, energy development, and education. Participants came from a variety of geographic regions, with IHEs in States from South Dakota to Florida and spanning all Carnegie Classifications of research activity, as illustrated in Figure 1.[2]

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1 See also the 2024 NSF report to Congress, *Artificial Intelligence Scholarship for Service Initiative*, which assessed the need for an AI-focused program to bring AI and related talent into government agencies. https://nsf-gov-resources.nsf.gov/files/2024SFSAIReport-r.pdf

2 The 2025 Carnegie Classifications for level of research activity are, from highest to lowest: Research 1 (R1): Very High Spending and Doctorate Production (at least $50M in research expenditures and 70 research doctorates per year on average); Research 2 (R2): High Spending and Doctorate Production (at least $5M and 20 research doctorates); and Research Colleges and Universities (RCU; at least $2.5M per year). https://carnegieclassifications.acenet.edu/carnegie-classification/research-designations/

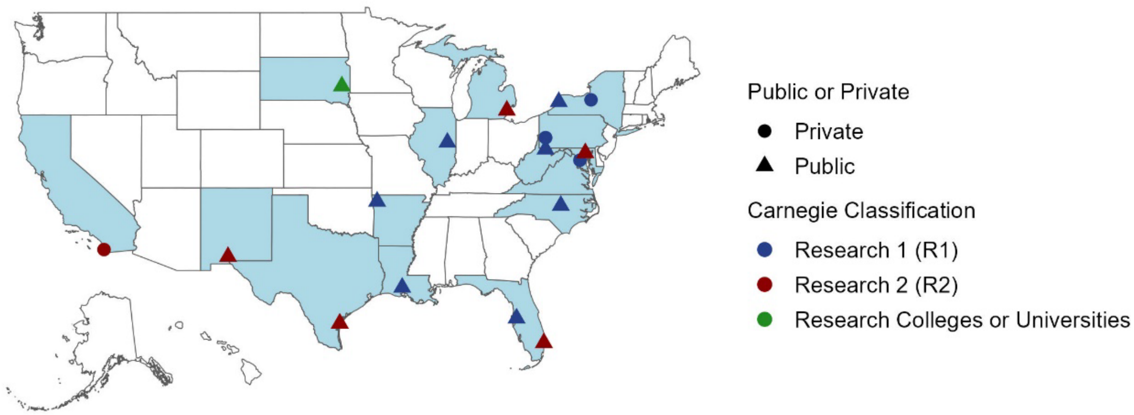

Figure 1. Institutions of Higher Education Represented by Workshop Participants

This report provides a summary of experiences, strategies, and visions discussed during the two-day convening. This summary highlights a diversity of perspectives and does not represent a consensus view among participants, though participants at times agreed on certain points. The following content was compiled independently based on the facilitators' documentation of discussion points, and was not reviewed by participants prior to publication. It is organized by workshop session, with some light editing for context, clarification, and structure. In each session on day 1, participants first held discussions in breakout groups and then reported back to a plenary session. Major points made in each session's breakouts and report-outs are summarized together. On day 2, participants rotated between topics in a collaborative "charrette" session in the morning, accumulating content in one working file per thematic area. In the final discussion session, participants documented ideas independently before sharing with the group; written and spoken content is summarized in the corresponding section of the report. In some cases, similar comments were made from session to session; in general these topics were preserved whether they were unique or strictly within the intended scope of the session so that key points of discussion were not lost.

2. Session One: Defining and Scoping AI Education Across Disciplines

Participants did not come to a consensus on what AI education across disciplines should look like, and suggested that a universal definition of interdisciplinary AI education is neither feasible nor necessary. Instead, workshop participants elucidated key motivations and features of interdisciplinary AI programs or activities based on their experiences in different fields and at different institutions.

A. Motivation for AI Education Across Disciplines

Participants discussed different motivations for considering or developing interdisciplinary AI programs. First, some participants suggested that interdisciplinary AI skills are viewed as integral for student workforce readiness or meeting industrial workforce needs, since most employers want AI-literate professionals and most students perceive that these skills increase their competitiveness for jobs. Participants pointed in particular to industry demand for students with AI skills within their regional location, including a recent case of a local company bringing real-world projects to students with the skills and knowledge to apply AI in the company's specific industry domain.

AI is increasingly viewed as a general-purpose skill or tool, like math, and is becoming important across academic disciplines. Some participants argued that universities must begin incorporating AI across other disciplines to stay on the forefront of research in any field, to modernize their major fields of study, and to bridge skills gaps and help students without deep AI technical knowledge gain relevant AI competencies. Such efforts can also help their programs to be competitive with those of other IHEs—especially at the master's level—and with other education delivery modalities such as bootcamps or online courses. AI education in the form of certifications or concentrations could help universities remain competitive with Coursera-style bootcamp options for gaining AI skills.

Overall, participants suggested that development of interdisciplinary AI programs can be driven from both the top down (e.g., incentivized by Federal or State-level funding via grant, or at the priority of IHE leadership) and bottom up (to meet student demand for AI educational opportunities).

B. Approaches to Interdisciplinary AI Education

Some participants highlighted a distinction between programs focused on AI that incorporate content from another discipline (often referred to as AI + X) versus programs focused primarily on a particular discipline that incorporate an AI component (referred to as X + AI). Participants discussed the difference between "AI + X" and "X + AI" programs, sometimes framing them similarly to computer science (CS) + X programs established in the past. In particular, some suggested that AI + X programs are more technical and emphasize CS skills or coursework while X + AI programs tend to be initiated by the non-AI disciplines and focus on applications of AI rather than deep technical expertise in AI foundations. One participant suggested that AI + X and X + AI should be synonymous, since the AI and X components should be weighted equally to be truly interdisciplinary from an educational standpoint. Participants debated this point and also discussed the possibility of a continuum from AI to X. Some agreed that AI + X would include core AI knowledge with domain-specific applications or context added while X + AI degrees would focus on an X discipline plus AI skills for the specific field. Another way of framing the distinction is: X programs use AI applications while AI programs focus on developing new methods and algorithms.

Participants suggested that all interdisciplinary AI programs should teach core AI skills like statistics and coding but that the depth of theoretical content should vary by application or domain area (e.g., an AI emphasis in agriculture will be different than that an AI emphasis in mechanical engineering). Moreover, the size of an institution, participation of industry partners, or availability of resources and qualified faculty may play a role in shaping the AI programs implemented by universities, including the degree types, curricula, disciplines, and technical rigor of a particular program. Several structural and administrative barriers to developing AI + X programs were also discussed, namely the lack of available accreditations for new AI-specific tracks and an absence of classification of instructional program (CIP) codes to permit coding of AI + X degrees to inform IHE reporting and administrative policies.

a. Core AI Content

Many participants believed that interdisciplinary AI students should have an understanding of AI fundamentals, including AI systems, functions, and tools. Some highlighted a need to include the basics of CS, data literacy, and programming, which one thought should also be integrated into a university's general curriculum. The option of including an introductory AI course as part of an IHE's general education requirements was also raised. One participant commented that their institution currently requires all students to take a data and information literacy course. Another said that their university has developed a Data Science Academy to support interdisciplinary education and implement data science education across departments, a model that could be considered for AI. It was also suggested that computational literacy does not have a universal definition, and while some States have developed standardized curricula for certain subjects through the Common Core, adding AI literacy to these guidelines could be a slow and difficult process.

It was also suggested that a student's AI education should bolster their understanding of their non-AI discipline, and should vary depending on what that discipline is. There was disagreement regarding whether students should focus on their X discipline or on a fundamental AI education in an interdisciplinary AI program. One participant argued that students at their IHE are eager to highlight their technical AI skills and feel more drawn to AI courses, but others thought of AI as more of a tool and suggested that programs should focus on AI applications for the other discipline. Participants also identified the potential for AI tools or methods to help transform research or education within the non-AI discipline.

Interdisciplinary AI programs can have different course loads or ratios, with AI + X degrees requiring more AI-focused credits than X, and vice versa. Different departments may structure programs differently. For example, a non-AI discipline could offer an AI concentration, or the option for students to include an AI minor along with their major field of degree. Alternatively, students could be allowed to decide what concepts they want to learn and to what extent. Participants noted difficulty in finding faculty qualified to teach graduate-level foundational AI or CS courses, and ongoing faculty training in AI for X disciplines was considered necessary.

The group discussed challenges in attracting and hiring new faculty members who could teach AI courses, and the possibility of upskilling existing professors to teach interdisciplinary AI programs. One participant added that AI + X programs should be taught jointly by X and AI experts, but that the ratio of AI to X courses would depend on the X discipline. For instance, an AI + engineering curriculum would look different from an AI + social science curriculum, and both programs would establish different benchmarks for AI competencies. One participant elaborated on this point and suggested that even though the definitions of AI within AI + X and X + AI are different, it could make sense to define AI competencies at the national level and adjust them based on institutional or disciplinary needs.

b. Program Structures

A variety of program structures have been implemented at different universities. A participant from a small university said that they embed AI + X into coursework, capstone projects, or extracurricular activities. Two participants mentioned that their universities operate interdisciplinary AI programs with governance across multiple departments, including one standalone AI department that operates interdisciplinary programs in collaboration with multiple departments. Another participant said that most AI courses are taught within CS departments and suggested that credits are not easily transferable to other schools or colleges of a university.

Participants also discussed difficulties associated with integrating X courses within an established AI program. Finding faculty knowledgeable and qualified to teach both AI and an X discipline was commonly mentioned, or finding those with the time to develop and implement new, interdisciplinary curricula. In addition, isolated efforts of traditional disciplines could pose challenges, with one participant suggesting an institutional culture of collaboration is needed to avoid compartmentalization within the boundaries of a single department, especially if IHEs have constraints around credit-sharing across departments. Participants also raised the concern that course requirements of an interdisciplinary program could burden students. It was proposed that an AI program could be created to accommodate a larger than standard number of credits reserved for electives so that students have flexibility to take non-AI courses.

Participants suggested team teaching across AI and X disciplines could benefit from contributions from industry experts, especially since AI technology is evolving so quickly that it is difficult for faculty to constantly upskill. The group debated the merits of relying on industry expertise when faculty resources are scarce. A few participants acknowledged that visiting faculty from industry could help with curriculum development, teaching gaps, and specific AI application coursework. However, some suggested that it would be difficult to incentivize industry experts to enter academia; one person expressed concern that including non-academics in teaching roles would lessen the quality of education students receive. Nevertheless, participants agreed that industry plays an important role, especially since workforce needs could guide what students are interested in studying.

c. Funding and Institutional Culture

Participants discussed hurdles they have faced in funding interdisciplinary programs. The conversation suggested that success depends on institutional and financial backing for such programs. One participant mentioned that their university received state grants and secured public-private partnerships to develop and implement their AI + X program. However, the same participant elaborated that even with institutional and state support, growing these programs has been difficult and slow. Support from administrators is necessary and can help programs grow more quickly.

Industry partnerships present an opportunity to bring IHEs both funding and real-world problems for students to solve using AI. One participant mentioned that their university is planning to roll out multiple AI + X undergraduate programs where students will have access to industry partners to conduct projects relevant to the tech industry. The participant was hopeful that these partnerships will help with workforce development. Similarly, one participant shared that their university has a Data Science Academy that employs researchers from industry to teach students their specific discipline of expertise, which has helped reduce teaching gaps. One university representative shared that their institution has developed partnerships with regional industries, which has helped them develop a specific AI + X program to address workforce needs. The participant noted that industry and university collaboratively designed the curriculum and industry partners are meeting with students for data science and AI tasks.

3. Session Two: Designing AI Programs and Activities Across Disciplines

To learn in more detail about more about how participants' programs were developed, participants were divided into five small groups, with some groups comprising individuals from similar disciplines. These small groups discussed how, and with whom, their cross-disciplinary AI programs or activities were designed, including what educational content is valuable for different institutional and disciplinary contexts. This chapter summarizes highlights of these discussions and their report-outs to the full group.

A. Approaches to Creating Program and Activities

Participants discussed their unique approaches to formulating new AI + X programs, which reflect the different opportunities, resources, and needs of the represented institutions. Many noted that they had already begun a new degree program, and were hoping to create others based on what they had learned from the first. Two participants specified that the nature of new programs can vary with institutional culture and capacity for collaboration across departments or colleges. One participant in particular mentioned that their university initiates new interdisciplinary programs through memorandums of understanding between deans. In contrast, one participant noted that teaching faculty at their institution have the flexibility and support to propose new degrees and certificates, which are then evaluated and co-designed with other departments.

It was suggested that the easiest approach to introducing AI education for students in another discipline is to begin with what already exists. Some institutions have AI degrees, for example at the master's level. Others could add tracks to existing degree programs—an X degree with an AI-focus track or an AI degree with a track focusing on applications to a particular field. The Georgia Institute of Technology's "threads"—an approach to customizing CS curricula to enable students to apply computational methods or tools to an area of interest—is an alternate model for weaving AI or X into an existing curriculum.[3] In between would be adding a minor or certificate of the complementary field. One participant who had attempted to create a minor in their field and failed noted that minors need to be relatively prerequisite-free for students to succeed.

[3] Threads: A Better Way to Learn Computing: https://www.cc.gatech.edu/threads-better-way-learn-computing

Participants identified numerous factors that influence their decision-making for new AI + X programs. A few raised the idea that departments can be strict about course ownership and credit hour distribution and will restrict students from taking electives outside of their department to maintain enrollment and funding. These participants noted that institutional support from the provost and dean is critical to ensure interdepartmental cooperation and the longevity of AI + X or other interdisciplinary programs. Another constraint mentioned was faculty capacity and training. In particular, one participant noted that faculty require domain awareness and a shared vocabulary across both AI and X fields to teach both disciplines, and training is necessary to prepare for blended course models. In terms of curriculum development, a few participants mentioned that industry partners are key in informing the program's content and learning outcomes and can enable capstone projects or act as advisors for students, or contribute as members of program advisory boards.

Institutional characteristics also influence design. Participants suggested that institutions with a track record of interdisciplinary education and research may be better suited to spinning up new interdisciplinary AI programs than those without such prior experience. State institutions may have some formal restrictions or requirements associated with creating new formal programs. For example, some State universities' program scope is constrained to align with a core mission, and some IHEs must receive approval of new programs at the State governance level. IHE access to technology resources also informs what institutions can offer. For example, graphics processing units (GPUs) may be needed to work with certain AI models, and institutions may need to build sandboxes or license commercial AI tools to keep student or research data internal to the IHE rather than permitting it to be accessed by the providers of the AI model or compute resources.

B. Program Content, Learning Goals, and Educational Outcomes

There was substantial discussion about how priority AI content and learning outcomes may vary according to academic field, institution, and student interest or career path. Some students will need to understand machine learning fundamentals, others will need detailed understanding of a wide range of AI algorithms and when to apply them, others will need to design or train their own custom models.

Trustworthy AI, AI ethics, and legal dimensions were viewed as important. One participant noted that elements of ethics are often included in fundamental engineering courses. It was suggested that laws and policies governing AI are still nascent, posing challenges to keeping curricula in these areas current. It was noted that ABET is working on guidelines associated with AI, and that it could be valuable for workshop participants to engage with that effort.

Several participants linked their educational programs to student employability and workforce needs. One wondered whether, at times, IHEs oversell their offerings as relevant for obtaining a job. Several pointed to employability as a key educational outcome; one from a small university said they aim for 100% employment of their graduates in their field of study within 6 months of graduation. IHE offerings can be informed by understanding what keywords are needed on a resume for students to be offered a job interview.

One faculty member said some of their students have found it difficult to get a job with only a core AI degree, as disciplinary knowledge was also valued in industry. Some participants suggested that AI knowledge can bring value to individuals in other disciplines and also make them more competitive. Some participants mentioned that it is important to know what industry needs, and try to ensure that students can deliver. Others pointed out that programs can empower students to learn the fundamentals of AI and how to apply or translate specific concepts and models to solve new problems, and bring new ideas and opportunities to an industry that have not been thought of before.

One of the key educational outcomes discussed by participants was workforce readiness, and the majority of the group agreed that students should graduate with X-specific knowledge and sufficient AI skills to meet employer demand. To this point, varying opinions on what constitutes AI literacy were voiced, and while some participants argued that students may only need to learn AI as a tool within their discipline, others opined that students should also have a deeper theoretical understanding of the technology. One participant highlighted that these programs should aim to reduce barriers to understanding AI to combat backlash and build trust in AI tools. Participants also commented that AI ethics and responsible AI should be an aspect of all AI + X degree types, with one participant suggesting that programs could incorporate ethical reasoning and social responsibility across learning activities like hackathons.

Participants had varied responses to the question of what an AI + X curriculum should include. Many agreed that a core AI curriculum would consist of a mix of math principles, programming, and statistics but debated to what extent students should obtain proficiency in these concepts. One participant stated that, at their university, courses on data literacy are integrated across all schools and majors and offered as part of the university's general education. One noted that students at their IHE have access to electives in AI areas such as natural language processing, deep learning, and robotics. Another participant mentioned that integrating a non-AI discipline into AI education has involved a lot of compromise and their university set up a committee with faculty from each school to help shape the degree's curriculum. This approach sparked substantial interest within the rest of the group and while participants could agree that this collaborative approach is necessary for a successful interdisciplinary AI program, many felt that it would not be achievable since credit hours are not easily transferred between departments and schools. The group also enumerated ways students could fulfill an AI + X education outside of the classroom with experiential learning. Participants brought up activities including internships and co-ops funded by the university, poster competitions with industry partnerships, and hackathons or research fellowships.

C. Distinction Between Interdisciplinary AI Programs and Core AI Programs

Participants identified that interdisciplinary AI programs differ from core AI programs in both goals and structure. Some participants argued that core AI focuses on algorithm development and technical depth and AI + X programs emphasize applying AI within specific domains like engineering, humanities, or education. Participants discussed how these programs can be co-taught by AI and domain faculty, offering integrated courses, while X + AI models can start from the disciplinary perspective and add contextual AI literacy. One key challenge with interdisciplinary AI education is developing a shared vocabulary across disciplines, which would enable more cohesive learning. Another participant suggested that so-called “bridge” programs like minors, certificates, and flexible electives could be a solution to help non-CS students access AI education and engage with these tools meaningfully.

D. Lessons from Specific Disciplines

Participants discussed the variety of needs for AI in different disciplines. Integrating AI into fields like CS, cybersecurity, or computer game design may, to some extent, be occurring naturally since AI methods are inherently related and their utility is apparent. Some participants suggested that convergence is also beginning to occur at the graduate level in other science and engineering fields due to the utility of applying new AI methods for research and development—similar to how other computer algorithms and programming methods have been applied in the past. Others disagreed, suggesting that it may be hard to integrate AI into other fields. Several conversations arose between individuals with similar backgrounds, yielding additional details on incorporating AI into specific disciplines, including cybersecurity, agriculture, and engineering.

One participant shared their experience in leading development of a program of study in Cyber AI for the National Security Agency’s National Center for Academic Excellence in Cybersecurity (NCAE-C). This effort was conducted with broad community input, including webinars and workshops convening hundreds of experts, including Federal Government experts, to develop knowledge units, topics, and outcomes for “security of AI” and “AI in cybersecurity”—analogous to X + AI and AI + X. The content strongly emphasizes math, due in part to the priorities of AI-focused contributors, and also includes AI governance, ethics, and law. These program frameworks can be broadly adapted and applied at any NCAE-C and potentially other IHEs to help meet Federal Government and other workforce needs. This effort was initiated rapidly, with partial funding from NSF, with the first workshop held in March 2024 and output completed by around September of that year.[4]

Cybersecurity and AI share common technical CS topics and pedagogical foundations; the approaches or content in the Cyber AI program might not apply to Xs with fewer technical commonalities. Another participant noted that their institution offered a master's program in humanities and technology. While CS faculty were initially engaged in this effort, interest was more with use and understanding of available commercial AI tools, such as for generative AI, rather than gaining a deeper proficiency with the underlying methods and algorithms. Participants suggested there might be more common content for other scientific fields, such as biology, or with engineering fields that could enable a more even balance in technical emphasis between AI and X.

Several participants with an engineering focus commented that engineering graduate program requirements often already include a background in programming (especially python), linear algebra, statistics, mathematics, and data structures—which also are helpful for technical AI work. For students who do not meet these prerequisites, they may have special courses to bring them up to speed, but this also takes faculty. At one IHE that had previously created a CS + X program (where X was engineering), faculty found it challenging to identify students that could complete the program. For the IHE's new AI engineering program, courses housed in the engineering school expect students to have an engineering background rather than CS, which can make alignment challenging. Engineering degrees, in particular, also have numerous technical course requirements, making it challenging to remove requirements to accommodate relevant AI courses.

Discussions around AI for agriculture (or agriculture + AI) emphasized the importance of project-based learning for making strong connections to the domain. One faculty member commented that they emphasize robotics competitions, along with opportunities to solve real-world problems using AI, rather than focusing on deep theoretical foundations of AI. In addition, students of agriculture often come in with a variety of experiences, so agriculture courses must teach to different backgrounds. One participant noted tension between the people focused on agriculture and those with a CS background. Another said their IHE had a data science course geared towards individuals studying environmental science, with a focus on techniques, including machine learning, that can help them to learn more about their data.

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4 NSF CAE-AI Workshop: https://wp.towson.edu/secured-lab/nsa-cae-ai-workshop-march-2024/; Cyber AI Programs Stoneman v.1 August 2024 https://drive.google.com/file/d/14EjfXHIyfvMI_HDfpbhtcYk4sqYh0BiL/view

4. Session Three: Resources and Strategies for Implementing and Sustaining AI Educational Programs and Activities

In the last session on day one of the workshop, participants were asked to focus on key resources needed to implement their AI educational programs or activities, and on strategies for navigating the logistical and administrative aspects of program implementation and sustainment. This chapter summarizes key insights in these areas, reiterating some points already made while also covering new ground.

A. Recruitment of Students

Participants spoke to their experience engaging and recruiting students into their AI programs and activities as well as distinctions between undergraduate and graduate recruitment and for recruitment into core AI versus interdisciplinary AI programs. Several noted that their institutions actively advertise or market their programs. For example, one faculty member worked with their IHE's marketing team and used social media to advertise their AI master's program. It was suggested that any advertising for an interdisciplinary AI (or AI + X) program should be conducted jointly between the departments or colleges involved. At a different IHE, students who have been through a relevant program act as student ambassadors to help advertise the program. It was noted that happy graduates are a great resource for increasing student recruitment and engagement.

A participant noted that they do not actively recruit for their regular graduate program—this school has low tuition for out-of-state students, and most of their international students come into programs with financial support—but they do have faculty talk to students about their AI graduate certificate program. One participant suggested that IHEs do not need to recruit individuals into engineering and CS programs, though branding and marketing are always helpful, but that there might be a need to advertise an AI + X program to change the way that candidates think about the X side. It was also suggested that it can be difficult to recruit students for interdisciplinary studies. For example, one person commented that it can be hard to find graduate students with the correct AI and correct X background to thrive in a specific AI + X program. Tutoring or other remediation for graduate students could be helpful to fill gaps in their backgrounds.

One participant said that they leverage social media, billboards, and radio advertisements, as well as hosting 600-student events at STEM-focused high schools, to recruit individuals into their undergraduate program. Another pointed to “roadshows,” where teams of experts visit different high schools to provide a fun introduction to their programs. Their undergraduates can work with enrollment counselors and faculty advisors, participate in their active AI club, or be sponsored to attend conferences. Others also suggested that clubs or extracurricular activities can reach a variety of students, including nontraditional students. Emphasizing the workforce possibilities of an AI education can also be an effective approach, as can framing discussions with potential students about relevant topics in a fun way to increase early engagement.

Programs designed with an accelerated 4 + 1 pathway to a graduate degree (that is, curriculum designed so that only one additional year of study is required after completing a bachelor’s to attain a master’s degree) also have a high success rate in producing master’s graduates. Another participant said that they give presentations to first-years to recruit them into an undergraduate program after they have already enrolled in the IHE, a different approach than used to recruit master’s students. Undergraduates who have a positive learning experience are more likely to go into a related graduate program.

There was some discussion about the potential effects of reduced international student enrollments in the United States. It was suggested that significant decreases could affect U.S. graduate programs, for example, through loss of international student tuition.

One participant suggested that people entering undergraduate programs might be more focused on post-graduation earnings, while graduate students might prioritize work-life balance. Another participant noted that, even at the graduate level, students may be focused on earnings, though scholarships and grant or tuition offsets might ease related concerns.

B. Obtaining Necessary Resources

Participants discussed a variety of resources needed to sustain their AI or AI + X programs, including funding in general, faculty, student scholarships, computational and data resources, curricular resources, and input and engagement from industry. One participant asked their colleagues how to educate a university’s board of regents about the importance of AI and opportunities to secure resources and support needed to advance interdisciplinary AI education. A participant who has had extensive engagements with their board of regents said that they invite board members for discussions any time they are on campus, even catching up with them informally at campus events. Most of their board members are business professionals, rather than educators; it’s important to show them the possibilities of what AI and related programs can do. An “edutainment” approach can be helpful. For example, when the IHE proposed their AI master’s program, they created a digital personality to interact with board members. It also helps to have IHE leadership with expertise in AI.

Qualified faculty and sufficient faculty lines to support educational programs were identified as important resources. Some participants said it has been challenging to hire AI faculty, with only approximately 10 percent of qualified candidates entering academia, and substantial competition for candidates among IHEs. However, one participant noted their IHE would likely not consider hiring individuals with interdisciplinary backgrounds as opposed to "pure AI."

One participant asked how IHEs could reduce the salary gap between academia and industry, with another stating the gap has exploded. One person noted that their university's board of regents sets salaries based on CIP codes that characterize the field of degree; their program is designated with a CIP that enables them to offer salaries higher than any other college. Another said it is necessary to be creative and work proactively and aggressively to retain faculty members. It was suggested that academics could do a better job at "selling" their students on the quality of life in an academic position, which is generally a good one. A participant added that faculty cannot do everything, and that staff support is also critical.

Participants also mentioned the current or potential role of NSF-funded programs such as Research Experience for Undergraduate programs, and the Scholarship for Service (SFS) Program; one person noted that scholarships are the number one recruitment tool, and the SFS program culminates with a job at the end.

GPU and compute power were also identified as important resources for AI education. One participant from a public university noted the value of their on-campus lab with substantial GPU and other computing and communication technology capabilities for use as learning environments, of which 40% of the cost was covered by their State. The importance of data, especially data specific to subject domains of interest, was emphasized, but not all faculty are willing or able to share their research data for other uses. It was noted that data could be better democratized, and perhaps the National AI Research Resource (NAIRR) Classroom effort could help.[5]

Participants noted that shared curricula or models for curricula could be helpful resources, and that these could be compiled in a repository, perhaps maintained by an NSF AI Institute. One person said that their IHE has a content moderation team that reviews every proposal to identify resources needed and available and make the most of what they have and what they develop.

Industry contributions can also be valuable for obtaining critical resources. For example, the private sector might facilitate data sharing agreements or special contracts to help support faculty positions and research. Legal support is often needed to develop these relationships and agreements. IHEs could also consider creating visiting professorships or adjunct faculty positions that permit industry experts to teach at their institution. There also

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[5] See https://www.nsf.gov/events/nairr-pilot-classroom-partner-showcase.

may be cutting-edge research areas that can be informed directly by input from industry experts. Tax breaks or other incentives for industry that provide IHEs with needed resources could also help to stimulate capacity building.

C. Challenges and Adaptation of Approaches to Interdisciplinary AI Education

Participants briefly discussed challenges associated with integrating AI topics into other disciplinary programs, and approaches they took to adapt. One participant shared they had made incorrect assumptions about the level of comfort their X + AI students would have with technical AI and computing topics, and had to change the scope and approach of their teaching. In response, it was suggested that AI needs to be demystified, and that more general education around AI is needed. One approach to filling educational gaps could be to conduct AI clinics, analogous to an approach that has been taken for cybersecurity. Participants also discussed the degree to which faculty should be trained to use AI tools in general, and the point at which AI tools add to a student's educational experience.

Another participant pointed out that there has been backlash against use of AI models due to instances where their outputs are not correct, for example, when classifiers yield too many false positives. At the K-12 level, superintendents and teachers are worried about the dependency of students on AI. One participant said that their IHE assigned an English professor to be interim dean, who then helped to persuade non-STEM faculty to make AI an optional track in their programs, bringing AI to core X curricula.

Participants also noted that programs should change over time as AI technologies change and gain further public value. Curricula should be flexible and able to adapt to the pressure to keep up with rapidly changing technologies and contexts for AI.

5. Session Four: Enablers and Barriers to Designing, Implementing, and Sustaining AI Educational Programs or Activities Across Disciplines

On the second day of the workshop, participants were asked to revisit and expand upon insights from the previous day, framed through the lens of enablers and barriers to building educational capacity in AI across disciplines. This session focused on four thematic areas: Stakeholder Engagement, Resources, Interdisciplinarity, and Institutional Characteristics. This brainstorming session occurred in the form of a "charette," in which participants rotated from topic to topic and built on the ideas generated by individuals that preceded them. Through this process, participants assembled key takeaways from their experiences that may serve as guidance to faculty and administrators at IHEs that may be considering implementing their own programs or activities to build capacity in AI education across academic disciplines.

A. Stakeholder Engagement

Participants identified many different stakeholders involved in building capacity in AI across disciplines at IHEs, including Federal and State governments, university administration, faculty, industry, and students. Participants noted that these stakeholders acted as enablers or barriers depending on the IHE and the context of the program or activity.

1. Federal and State Governments

One of the major stakeholder types that participants noted was government organizations, both at the Federal and State levels. Government organizations are a major source of funding for AI + X programs and activities. A few participants found success by working with smaller State organizations that had focused missions, where these organizations became advocates for building educational capacity in AI + X. These participants also noted that it was easier to convince government entities of the importance of AI + X by associating key AI skills with a regional industry (e.g., the automotive industry).

Additionally, State governments can help facilitate the approval of new programs and new degrees. However, some participants shared that, in the same vein, State governments can act as a barrier if they must approve new programs.

2. University Administration

Participants noted that flexibility in administrative structure and procedures—along with flexible administrators—was an enabler. One participant articulated that flexible administrators allowed for new courses to be developed with streamlined approval processes. Others echoed the fact that flexible university administration allowed them to adjust to rapidly changing contexts surrounding AI. Additionally, another participant purported that having experts in AI + X at the leadership level in the administration allowed them to be champions of AI + X education, helping the university garner support from government and industry stakeholders.

However, participants noted that university administrators could also act as a barrier, especially when they must be convinced of the need and value for AI + X programs. One participant cited a reluctance to invest in new AI + X programming on the part of university administrations. Many participants echoed that there were budget constraints and that administrators had profitability concerns about the sustainability and long-term objectives of new AI + X programs. One way to overcome these challenges is to be persistent in educating administrators about the importance of AI + X education. Examples of questions that university administrators posed include:

- Will the program or degree still be relevant in the next 10–20 years?
- How does the university convince students and parents of the long-term sustainability of the program or degree?
- How does the university market the programs to get enough enrollment?
- Where (in which department) will the program be housed? How will the university find faculty to teach the related courses?

3. Industry

The private sector was mentioned as a major stakeholder, as it can act as an enabler by driving student demand and can be a source of funding. Participants noted that when an industry communicates its AI needs, it can generate a lot of student demand to build capacity for AI + X at universities. Some participants have also found success with public-private partnerships for their interdisciplinary AI programs, noting that companies have invested in IHE research and training and mentoring programs related to AI in other disciplines. Private sector contributions can include funding for joint research projects or senior design projects, scholarships, fellowships, internships, named professorships, and joint centers.

Simultaneously, there are challenges when involving industry in building AI + X capacity. One of the main challenges participants brought up includes the fact that industry is focused on short-term goals rather than long-term goals of the discipline. Additionally, when companies are unsure of the AI skills they will need in their workforce, it is difficult for universities to set up AI + X programming that targets the industry. Lastly, multiple participants commented that working with industry can present data privacy and intellectual property (IP) barriers.

4. Students

Participants remarked that students were either an enabler for building AI + X capacity by driving demand or they were a barrier due to their lack of interest in AI + X programming. Whether students were described as an enabler or a barrier depended on the IHE. For some IHEs that are known for their CS departments and AI research, students were a major enabler, especially non-traditional students who had already earned bachelor's degrees but wanted to upskill with AI competencies to enhance their competitiveness in the job market.

Other participants expressed that the lack of certainty and clarity about how AI + X will impact future career opportunities made it difficult to recruit students for their AI + X programming. Overcoming this barrier requires raising awareness of the utility of AI skills in other industries. Some activities highlighted by participants include:

- Partnering with professional societies to sponsor AI + X workshops and increase awareness of AI + X skills;
- Extending communication to student spaces (e.g., social media, student housing);
- Leveraging successful students to showcase the benefits of AI + X skills; and
- Financial support for AI + X programming or activities (e.g., scholarships, tuition waivers, paid research assistantships).

5. Faculty

Faculty can enable AI + X programs in many ways. Participants noted that certain faculty and departments are proponents of embedding AI education in their non-CS disciplines because student enrollment in their programs has declined compared to CS or AI disciplines. Faculty can also be enablers of AI + X programs when they are active AI + X researchers themselves; this allows them to create research opportunities for students, identify real-time AI needs in their non-CS discipline, and promote awareness and active participation in AI + X research.

However, faculty can also pose barriers to establishment of interdisciplinary AI education opportunities. Participants suggested that some faculty may not be supportive of increasing capacity in AI across disciplines. For example, there may not be a sufficient number of faculty members to teach the new courses, and there might be infighting among departments and faculty over course ownership and internal competition for external grants. One suggested solution was to have joint faculty appointments, especially in departments that are more open and flexible to new types of programming and education.

6. Other Stakeholders

A few participants pointed to additional stakeholders. Professional schools (e.g., medical schools and law schools) were named as potential enablers, because their students have demonstrated interest in AI and drive demand in AI educational activities for non-CS disciplines. Two-year IHEs and K-12 schools were also cited as potential enablers, as they can act as a student feeder to four-year IHEs. One participant shared that the opportunity to engage with students from two-year IHEs and K-12 schools could help to build a student pipeline for their AI programs.

Lastly, one group of participants in the charette discussed the lack of alignment across stakeholders in how to build capacity in AI across disciplines. All stakeholders have varying needs, which create competing priorities for university programs and activities. These participants noted that many faculty members and administrators do not have a vision for the goals and outcomes of AI programs in non-CS disciplines. Consequently, it is difficult to define and assess success in the program.

B. Resources

Participants identified a variety of resources that can facilitate capacity building for interdisciplinary AI education. Funding enables IHEs to develop or access many other resources, such as research centers that can support educational activities, faculty, specialized student advisors, and infrastructure. Partnerships may also help to make such resources available. Some participants also described resources that their IHEs have developed for stakeholders beyond their own IHE. Other resources needed to build capacity include student interest and enrollment, data and computing resources, dedicated campus space and facilities, educational content, and infrastructure.

1. Funding Sources and Mechanisms

Participants highlighted the importance of funding as an enabler for building and sustaining educational capacity. For example, one participant said that NSF funding for AI Research Institutes was crucial for their efforts to develop, support, and implement AI education initiatives at all levels. The participant noted that NSF also had agile mechanisms for quick supplemental funding on existing grants, another key enabler. Funding for research includes support of graduate student research contributions, a key part of their education and training.

2. Scholarships, Fellowships, and Traineeships

Scholarships, fellowships, and traineeships were identified as a mechanism for incentivizing U.S. international competitiveness and workforce development. Examples raised include the NSF Research Traineeship program and the Innovative Technology Experiences for Students and Teachers. Participants suggested that similar opportunities explicitly targeting interdisciplinary AI experiences would also be helpful. One participant mentioned international student and faculty exchange programs for both AI and X as another approach to consider for enriching the IHE's program and student experience.

Flexibility in finding atypical or nontraditional funding sources, such as from nonprofit organizations or think tanks, was also identified as enabling. It was noted that priorities of private equity firms or foundations can generally change as a function of government priorities. One participant suggested that IHE-created continuing education resources, or customized training resources for upskilling and reskilling members of the current workforce, could be used to generate additional revenue for an IHE.

Participants noted that funding cuts and freezes can be significant barriers to developing AI education capacity. Reliance on short-term funding presents uncertainty for academic programs and can interrupt the implementation of AI education initiatives to full completion. It was also noted that loss of funding to increase enrollment of domestic students in AI and related disciplines can reduce the overall level of participation in AI education activities and create a barrier to meeting workforce needs.

3. Students

In addition to being stakeholders, students can be thought of as a resource whose demand for and engagement in interdisciplinary AI education can either enable or inhibit efforts to increase U.S. capacity in AI across disciplines. Participants discussed the potential value of raising awareness about the relevance of AI to other disciplines as a means for increasing the potential pipeline of students and for the purpose of recruiting. One participant pointed to the approach of bringing AI experts to give keynote presentations at conferences for non-AI disciplines. Such presentations can be designed to provide a fun introduction to how AI tools and methods can be useful in different academic disciplines and application areas and get student attendees excited about the prospect. Sending AI or AI + X faculty to speak at such conferences can also call attention to their home program and institution, and potentially help with student recruitment or in raising the IHE's profile in interdisciplinary AI.

Participants mentioned uncertainty in the stability of international student enrollment as a potential barrier to building and sustaining interdisciplinary AI educational programs and activities, especially at the graduate level, as a large share of graduate students have historically been international. Participants also noted the possibility that low-income students may be less inclined to participate in PhD programs, which typically take longer to complete and for which stipends are typically less than salaries at jobs that only require a bachelor's or master's degree, due to a need to make enough money to help support their families. This need can constrain the extent to which PhD-level workforce capacity building can effectively draw from all segments of the population.

4. Faculty

Faculty appropriately knowledgeable and skilled in AI and other relevant disciplines are a critical resource for capacity building at IHEs. Participants noted that it can be difficult to find faculty who are qualified to teach in AI + X programs. In particular, the ability to offer competitive salaries in comparison to industry or peer institutions can affect an institution's ability to recruit and retain competitive faculty. Similarly, the home department of an interdisciplinary faculty member can have a profound influence on the salary that can be offered—a disparity that might discourage individuals focused on a higher-paying discipline to accept a position in a lower-paying department. This challenge might also translate to salaries for research or teaching assistants to some extent. Participants proposed potential solutions to the salary challenge. For example, they suggested encouraging joint industry-academic appointments that might afford higher net income, or joint appointments between IHE departments or colleges to support a higher salary than might otherwise be offered in the lower-paying department. It was also suggested that IHEs could eliminate altogether the traditional department-centric models when hiring interdisciplinary faculty, or create new centers or colleges to house programs and activities related to AI at the intersection of other disciplines. Alternatively, IHEs could embrace differential salaries at the institutional level that align better with the market for relevant AI expertise.

Other approaches to meeting needs for qualified faculty include offering professional development or training opportunities to enable them to teach AI concepts in a discipline-appropriate context, and the possibility of making available library and tutoring resources to support students in such courses. Enlistment of specialized teaching faculty and professors of practice can also potentially help fill gaps in capacity for teaching AI across disciplines without relying solely on traditional, tenure-track appointments.

Participants discussed conditions and approaches that enable faculty to contribute to establishment and sustainment of AI educational programs and activities. For example, collaboration across segments of the IHE is important for interdisciplinary activities; acknowledgment of faculty members' interdisciplinary collaborations as part of the tenure review process could incentivize the kinds of engagement needed to build AI educational capacity across disciplines. Another incentive suggested could include providing interdisciplinary AI faculty with joint appointments across IHE departments or colleges with the opportunity for individuals otherwise appointed to a lower-paying department to receive salaries that are more commensurate with the higher-paying field.

It was also pointed out that research yielding AI algorithms or models is not necessarily published in traditional peer-reviewed publications that are the standard for many academic disciplines, but rather as conference papers or as preprints on arXiv. Such AI-related work might not be as highly valued as a part of a tenure package for individuals in non-AI disciplines, disincentivizing AI-related scholarship among junior faculty in non-AI fields. Deliberate decisions to count AI-related conference papers or preprints in tenure evaluations could help solve this problem. Similarly, some participants suggested that there may be no evaluation criteria for acknowledging faculty innovation, technology transfer, or entrepreneurship, which may be particularly relevant to AI research and development or important to faculty working in this space; this category could be deliberately included along with teaching, research, professional development, and professional service as part of faculty tenure review or annual review.

Finally, participants suggested that faculty resistance to change could present a barrier to increasing AI educational capacity across disciplines. For example, faculty might be reluctant to give proper weight to either the AI or the X component of AI + X education or scholarship, or might be uninterested in adopting new curricula.

5. Infrastructure

Participants discussed the importance of infrastructure for enabling AI education across disciplines, including physical and technology infrastructure. High-performance computing (HPC) resources and shared facilities were named as important for implementation of certain AI methods or AI model development. Training and professional development resources for faculty or researchers who wish to leverage AI-based approaches in their fields, including on using HPC, can also be enabling, as individuals may not know what is possible with AI or what kind of computing power they may have available or could benefit from. It was suggested that campus research computing groups often provide HPC resources to the community, but they are frequently overly technical and not "welcoming" to scientists who do not have CS backgrounds. As another example, access to low-cost minicomputers for field AI and robotics applications can support applied or interdisciplinary AI research and education.

Data are another important resource that can be viewed as enabling infrastructure for AI research and education activities. Participants identified several data-related barriers. First, it can be challenging to find or make available to academics the data sets needed for researchers or students to train AI models or for AI-enabled analysis or exercises in a given discipline. Incentives for posting or sharing AI-ready data sets could help. Medical or health-related data subject to HIPAA pose additional challenges, often requiring modification before they can be shared and used. On top of common data challenges, faculty in different disciplines may store their data differently, presenting obstacles when people try to work with data in a new format or when trying to combine potentially disparate data for new uses.

Finally, participants pointed to the need for campus space to facilitate interdisciplinary activities and interactions. Examples include dedicated collaboration spaces equipped with the equipment and resources needed for an interdisciplinary education or research activity, as well as spaces to permit convening of individuals across disciplines to help build community and permit exchange of knowledge and ideas.

6. Partnerships

Participants pointed to partnerships as a way to overcome resource-related barriers to building or sustaining AI educational capacity across disciplines. Partnerships between industry and academia could support alternative funding mechanisms, including establishment of industry-named or -endowed positions, or faculty joint employment between sectors, which could provide for greater income than might be offered by the academic institution alone. Accommodation of alternative employment or funding mechanisms could be enabled by IHE provision of flexible leave policies or special work agreements, provided IP issues are defined in advance. Participants also emphasized the importance of raising awareness among members of the local or regional community, for example by sending speakers from the IHE to raise awareness among the public and local industry, to build support and relationships—perhaps including creation of stipends to support such engagement.

7. Educational Resources

Educational resources—including course content and curricula, program models, and established learning outcomes—are also helpful for IHEs starting up new activities. Similarly, participants suggested that technology infrastructure to permit different modalities of interdisciplinary AI program delivery can provide flexibility to reach a wider range of students than traditional university degree programs or course formats might. Modalities range from in-person, on-campus coursework to remote-synchronous or -asynchronous formats or a hybrid approach. It was also pointed out that alternative modalities can also present barriers, as many IHEs do not excel at remote or hybrid teaching. Some participants noted that today's AI technologies can support content delivery, including for asynchronous formats. For example, rather than having faculty videotape themselves giving a lecture for later student viewing, they could potentially use generative AI to create a recording in what appears to be the faculty member's own voice based on training from past video lectures and prewritten lecture content for a new course. Another idea was to locally train a "teaching assistant" AI language model on the course's textbook to answer student questions. It was suggested that such approaches could help bring AI or X content to X- or AI-focused students in a supplemental manner. Remote, asynchronous modalities could also be used to provide free online courses for members of the university and surrounding community, as one participant had been pursuing on their campus, as an approach to "AI for all" that awards a certificate of completion. Such free courses could be sponsored by a center or an IHE and would extend access to the local community.

8. Ideas for New Resources to Facilitate U.S. Capacity Building

Participants identified ideas for new actions or resources that would facilitate additional U.S. capacity building in AI education and workforce development across disciplines. New funding for such capacity building could support a variety of efforts, such as funding for faculty positions or research, a series of education centers or "hubs" in AI + X across a variety of Xs, or creation of a clearinghouse or catalog of shared educational resources that could be adopted by IHEs or educators.

Establishment of a standing program to support sustained collaboration and discussion among AI + X experts could also help to build capacity U.S.-wide. Such a program could sponsor small workshops for networking and community building, as opposed to large conferences, and could convene academics, industry, and government.

It was also suggested that a follow-up workshop could be held to convene stakeholders to develop ideas for AI + X education hubs, including to identify key topic areas, hub models, and key resources needed for integrating AI across different fields. More generally, participants suggested that additional—and more deliberate—opportunities to bring together people with diverse expertise and backgrounds could help encourage collaboration across disciplines, as opposed to faculty always attending the same conferences with the same people from within a self-contained discipline. A catalog of conferences attended by interdisciplinary AI researchers and educators could be helpful to individuals seeking to identify new conferences to attend outside of their core discipline.

Finally, one participant suggested the creation of new IHE organizations, such as a "service academy" model, to build AI + X educational capacity for the purpose of meeting workforce needs in the public or private sectors. Such a model has been considered for cybersecurity, and could be helpful for AI. An AI + X or applied AI service academy could be sponsored by industry, and both government- and industry-focused, with graduates committing to work for the funders of their education for a fixed term in return for their tuition.

C. Interdisciplinarity

1. Collaboration Across Disciplines

A common theme highlighted by participants was the need for interdisciplinary collaboration between departments that offer AI-related courses/programs and other departments. One participant noted that ongoing efforts for collaboration between X and AI-related departments can be helpful in the establishment of successful AI for X programs. For example, including professors from an education or medicine (or other "X") department on an AI/HPC resource committee could be a way to facilitate interaction between non-AI professors and AI-related professors. Some participants discussed the importance of shared resources across disciplines in the facilitation of interdisciplinary interactions between AI and X departments. These resources could include computer hardware, such as computing devices and other physical infrastructure; software, such as computer power and storage; and other resources, such as budgeting templates or educational information. Consultations from AI experts to X departments was also discussed as another avenue for interdisciplinary collaboration between departments.

Participants identified other enablers to interdisciplinary collaboration, such as shared physical spaces between AI and X departments and external funding that promotes cross-disciplinary working groups. One participant suggested that a central AI institute or other structure housed at a university can serve as a central platform for AI for X programs across campus, regardless of the "X." Further, another participant discussed the importance of shared laboratory spaces that can lead to natural collaborations due to physical proximity.

Several barriers to interdisciplinary collaboration were identified by the participants, such as challenges relating to the instruction of AI and X disciplines. One participant highlighted the challenge of ensuring the coursework is sufficiently rigorous while still enabling students' success—as some students enrolled in X disciplines may not succeed in AI courses. Another participant noted the need to align a student's background with program outcomes to ensure success. Other participants discussed the challenge of recruiting or attracting students to AI courses in X disciplines. The administrative side of course offerings was also noted by participants as a potential barrier to AI for X courses. For example, several participants identified that if an AI course offering is limited, it may prohibit a non-AI major from taking the course. Furthermore, a participant highlighted the need for a shared platform for curriculum development to ensure that the credits align with both AI and X departments.

2. Institutional Culture

Participants discussed factors related to the institutional culture of universities that enable the successful establishment of AI for X education programs. One participant discussed the importance of an institution's historical posture towards interdisciplinary efforts and programs. That participant mentioned that it is easier to start an AI for X program if an institution already has a history of interdisciplinary efforts (e.g., conjunction of faculty, sharing course credits). Other participants discussed that a culture of interdisciplinarity may create a foundation for an AI for X education program. It was noted that a culture of interdisciplinarity may also lead students to more regularly seek opportunities outside of their home department. Attention and support from institutional upper-administration was also highlighted as an important factor in enabling AI for X education programs.

Barriers related to institutional culture were discussed by the participants, including administrative hurdles and faculty buy-in. One participant discussed the challenges associated with credit sharing between colleges and/or departments when designing an interdisciplinary program. The participant noted that interdisciplinary programs may require colleges and departments to "share" credits, or provide the credit revenue to the student's non-home department. Other budget models may require faculty to obtain a "faculty release" to teach a course that accepts non-major students. Participants highlighted that these and other similar budget models, or the way in which departments are credited with course revenue, can complicate interdisciplinary efforts between departments.

Faculty hiring and retention was another administrative hurdle that participants discussed. One participant noted that faculty resource requests (e.g., faculty on loan to another department) and the resource provided (e.g., salary) often do not match. Another participant discussed how it is difficult to find faculty that fit interdisciplinary AI for X education programs. Further, the need for industry-comparable salaries for AI professors was frequently cited as a barrier for the creation of AI for X education programs. Cultural characteristics, such as faculty "buy-in" to AI for X programs, was also discussed as a potential barrier. For example, one participant described that faculty may be reluctant to change their program requirements and may not support the establishment of an AI for X program. Participants recommended that in order to establish an AI for X program, advocates from both disciplines (i.e., AI and X) are needed to argue the benefits of the program to both the university and the student population.

D. Institutional Characteristics

1. Location

Participants discussed how aspects of their university's location could serve as either enablers or barriers of their ability to build and sustain AI + X educational programs.

It can be an enabler for universities to be co-located with local technology companies with a desire to leverage AI for their industry (e.g., biotechnology or automotive engineering). These companies may provide funding, offer co-op or hands-on learning opportunities, or inform curricula for a nearby university's AI + X program. There were no barriers noted to co-location of universities with local industry.

The local and regional economy of the area surrounding the university can also play an enabling role in the form of capital investments that may directly or indirectly benefit the university AI + X programs. However, some local economies lack sufficient resources leading to local communities that are generally underserved in various ways. In these situations, local students may have limited access to technology/infrastructure (i.e., internet or transportation), which could limit their ability to complete the coursework. Additionally, some participants shared that for universities located in smaller, more rural communities, the community, which reflects students they wish to enroll, may be less interested in high tech fields of study.

Two other aspects of location were noted by participants as barriers. Some universities are located in areas with relatively high costs of living, which means there can be financial barriers for some students to attend those universities. Some regions or States have multiple universities that must compete to enroll similar pools of students, which presents a challenge for a university to differentiate itself from nearby similar institutions.

2. Public versus Private

Many of the structures imposed by whether a university is public or private can be barriers or enablers of the university's AI + X programs. The two structures influenced by whether the university is public or private that participants focused on were the approval process to establish a new AI + X program and cost (i.e., tuition/fees) of their degree programs.

The participants described that when launching a new AI + X program, typically the program must be approved by the university's board (sometimes a board of regents, trustees, or governors, depending on the specific university). For public universities, approvals are often needed from statewide governing boards responsible for providing guidance and supervision of all educational activities across the State. In some States, all institutions in the State university system must approve of changes (i.e., creation of a new AI + X program), which can delay or impede these changes. In other States, while buy-in from all institutions in the State is not required, there are standardized State guidelines that all institutions must comply with in designing and launching a new program. Some participants shared that to be successful in obtaining approvals from State-level boards to launch a new AI + X program, it is critical to have high-level support from their university's leadership who can advocate on their behalf to State leaders. It was noted by some participants that personalities of their university leadership and State-level leadership can make a big difference in the timeline and process for getting necessary approvals.

In some States, the State legislature plays a role in the establishment or expansion of their public university system's AI + X programs. Some State governments (e.g., Florida, New York) have dedicated investments in AI at their public universities, which enables construction of supercomputer or other facilities, faculty hiring, and other activities critical to operating AI and AI + X programs. While such appropriations and mandates from State legislatures to build AI capacity at public universities can provide a large boost to these universities, State government leadership turnover can pose a challenge. For example, the State leadership may promise a certain level of investment over the next 5 years to their universities, but after new State leadership is elected, they may not honor those promises, leading universities in a difficult place, with many half-completed projects.

Private universities have fewer hurdles associated with approval of new AI + X programs and initiatives on their campuses, due to a more flexible and agile bureaucracy compared to public universities. It was noted by participants that getting early buy-in from individuals across the whole chain-of-command for approvals of new programs can help this process go more smoothly.

Participants noted that affordable tuition and fees, which are more closely associated with public universities, can be an enabler as their AI + X programs can attract a wider range of students. In contrast, high tuition and fees are a barrier to attracting students who may instead enroll in similar programs at more affordable universities. However, the participants noted that a lower cost program that also has a poor reputation will not attract students. Participants from public universities highlighted one unique factor associated with tuition: several States have entered into reciprocal in-state tuition agreements, such that students from any of these States can receive in-state tuition at any public university. These agreements can serve as enablers as they help attract students, due to lower tuition.

3. Carnegie Classification

Participants expressed differences in the enablers and barriers experienced by R1 and non-R1 institutions in establishing and operating their AI + X degree programs. Participants shared that R1 institutions are likely to have more faculty conducting research and receiving Federal funding in emerging and high-tech fields like AI than non-R1 institutions. Therefore, these R1 institutions already have access to some faculty and resources necessary to operate an AI + X degree program. Non-R1 institutions may have fewer faculty members and less Federal funding with which they can start up AI + X programs; however, participants were unsure whether Federal research funding was needed to develop new educational programs.

The incentive structure for promotion and tenure at R1 and non-R1 institutions was generally thought to be a barrier by nearly all participants. At R1 institutions, faculty are evaluated for promotion and tenure based on their research accomplishments, which can disincentivize the sizable effort needed to establish a new AI + X program or even the time and effort required to teach courses (as it is not uncommon for faculty to occasionally use their research funds to buy out of their teaching responsibility to be able to focus on research). Some participants from R2/R3 institutions felt that despite having higher teaching loads (typically at least two courses per semester) and fewer resources than R1 institutions, they were still being evaluated as if they are R1s (i.e., on their research accomplishments). Some participants felt that these barriers were especially high for R2 institutions that are aspiring to be R1 institutions. Other participants thought that universities not aspiring to be R1 institutions might have more reasonable expectations for their faculty. Participants generally agreed that changes to promotion and tenure evaluation could help—for example, a university could increase the weight to service related to AI + X activities.

One participant mentioned that public non-R1 institutions may have additional challenges establishing AI + X programs as they have the same State-level requirements to abide by, but without as many institutional resources as public R1 institutions in their State.

4. Institutional Reputation/Brand

Participants thought that having a university with a well-established and good reputation was an enabler in many ways. A good reputation can help attract faculty, as well as students, and to ensure that their graduates have a high placement rate in relevant industries. A good reputation also helps attract industry advisory board members, who can help shape the AI + X program to maintain relevance to industry needs. The opposite of each of these is true for an institution without an established good reputation, in that there are additional challenges to attracting students, faculty, and advisory board members.

Participants agreed that building an institutional brand takes a long time, is expensive, and can be hard to sustain. Instead, participants thought that designations like Center of Academic Excellence (CAE) or ABET can both help bring recognition to universities and provide a roadmap for demonstrating their capacity. The CAE community model, which was developed for cyber education, contains general information on cyber education that can be used by other institutions without having to reinvent the wheel.[6]

5. Institutional Funding Model

Participants expressed that there are aspects of institutional funding models that can serve as enablers or barriers of AI + X degree programs. They focused on where operational costs come from and how funds are distributed across the campus.

Participants shared that regardless of whether a university is public or private, a larger endowment, an alumni fundraising base, and other non-governmental sources of funding

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[6] CAE Community: https://www.caecommunity.org/

can be enablers for AI + X programs as they provide additional flexibility for universities to fund the associated start-up costs of these programs. Some participants shared that their universities have introduced AI professional certificates, and in some cases the revenue from these programs is under the control of the provost, meaning they can then invest the associated profits into additional on-campus AI + X educational activities. However, in some other cases, these AI professional certificates are housed within a business or management school and that funding stream stays within that school. Other participants shared that their universities have particular expectations about their degree program fully supporting itself with revenue from tuition, and that decisions about whether to keep or drop individual degree programs were sometimes made on this basis. Because AI + X programs can be cross-departmental or cross-college efforts, the revenue from operating the degree program gets split across departments/colleges, though not always in uniform ways, which can result in barriers due to an uneven incentive structure across the university.

a. Other Institutional Characteristics

Participants mentioned several other institutional characteristics that can serve as enablers or barriers to the establishment or operation of AI + X programs. One barrier mentioned by participants for smaller universities is that they may have a harder time ensuring there are sufficient AI + X-equipped faculty to cover all necessary knowledge areas.

University governance mechanisms—which are not necessarily related to their size, research intensity, or status as public or private—can affect the process to establish new programs. Some universities have governance structures that require large numbers of faculty from across the university to approve new programs, from which can be a barrier to securing buy-in. Other university governance structures, instead, elect small groups of faculty members to committees that can make decisions about approvals of new programs, which can serve as an enabler, as there is still shared buy-in but from a smaller number of empowered faculty members.

The college or school within a university where CS or AI education is housed can influence how easily they are able to attract current students to AI + X or X + AI educational programs. Many participants thought that institutions with a strong liberal arts student base might present opportunities to more successfully engage domestic students enrolled in liberal arts colleges in X + AI education. This ability to attract domestic liberal arts students to X + AI programs may be easier at universities where CS departments are also housed in colleges of liberal arts.

6. Session Five: Lessons Learned, Promising Practices, and the Future of AI Education Across Disciplines

In the final workshop session, participants were asked to suggest actions that could be taken in the near term to build AI educational capacity, envision the future of AI education across disciplines in the United States, and summarize their key takeaways from the workshop. They documented their ideas in writing, and everyone was given the opportunity to share at least one idea with the group. This chapter summarizes those ideas.

A. Actionable Ideas for Building Educational Capacity in AI

Participants proposed a variety of actions that could be taken by different actors to help build AI educational capacity across disciplines throughout the United States. These actions were informed by first-hand experience and through brainstorming over the course of the workshop; they synthesize many of the ideas and themes that arose across its sessions.

1. Initiating Discussion Within the IHE

Several workshop participants suggested immediate actions to take upon return to their home institution, including sharing information from workshop discussions with their department, college, or institutional leadership to help raise the issue and build support for capacity building. More generally, cross-department or -college discussions with relevant faculty and leadership, perhaps in the form of a workshop or conference, could help to identify what disciplines and departments would be best suited to engage for development of new AI programs, activities, or collaborations. Similarly, faculty could draft short proposals or give short presentations to their IHE leadership to propose development of a particular program that would provide value to the institution and its students.

2. Engagement Across the IHE

Throughout the workshop, participants noted that AI across disciplines is not one-size-fits-all. One participant suggested that IHEs take action by focusing on locally attainable solutions. Another recommended that IHEs strategically leverage their existing strengths to curate their AI + X program or activity. IHEs can deliberately work to ensure that any approach is in line with their institution's long-term vision.

IHEs can actively explore the possibilities for AI + X with relevant departments, faculty, and chairs. Such efforts could focus on identifying complementary strengths and needs in AI and other disciplines relevant to their educational community. Mechanisms for engaging across disciplines in the IHE could include convening cross-disciplinary work groups once a semester to explore or revisit needs and opportunities.

Faculty within a given discipline or department could hold brainstorming sessions to consider ways that AI can be used within their field, potentially informed by invited experts. AI experts can offer education to individuals in other disciplines to help reveal the opportunities for their field or to meet them. Another approach could be to organize an "X" conference with university administrators and AI faculty to discuss the possible need for AI + X degrees or other interdisciplinary opportunities. At the course level, cross-disciplinary workshops could be convened to enable faculty to provide a brief overview of a particular course offering and facilitate brainstorming sessions on how to incorporate AI into the curriculum.

3. Developing Interdisciplinary AI Programs and Activities

Participants also suggested active interdisciplinary collaboration in development of course content, so that the topics are smoothly integrated. Interdisciplinary programs could be co-owned by departments to permit sharing of responsibilities, resources, successes, curricula, and credit. Programs should also consider identifying the students they are trying to serve, along with the desired education or training outcomes. To focus on workforce readiness of their students, IHEs could gather input from employers about the job descriptions and duties that might be expected in a particular industry, to inform program, course, or activity design.

Other ideas include collaborative development of teaching materials at the intersection of AI with another discipline; development of standard AI + X curricula that may be widely adopted; and creation of an open-access, online platform to facilitate sharing of curricula, course content, and resources.

4. Program and Activity Types

Faculty or administrators interested in spearheading new efforts could create a list of other institutions' AI-related degree programs as models to inform the design of a new education program or activity at their IHE.

Program types identified included:

- An AI-specific track within an undergraduate CS degree,
- An AI graduate certificate, and
- AI minors available to interested students.

Other examples of opportunities to bring AI to students across disciplines included:

- Revisiting introductory courses in a variety of disciplines to offer "AI-enhanced" versions that introduce relevant AI topics in the specific context of topics in discipline X;
- Establishing course-based or extracurricular activities where students conduct demonstrations that bridge AI and another discipline (like autonomous robots);
- Conducting learning activities that focus students on finding problems or other issues with AI-related technologies to stimulate interest in future research;
- Hosting university workshops on AI for any X or for a specific X;
- Arranging for PhD students or teaching assistants with relevant expertise to offer lectures on AI designed for students in X courses; and
- Offering AI courses designed to introduce the topic to students of other disciplines.

5. Faculty and Mentors

Participants suggested that IHEs or specific departments bring in faculty needed to implement new interdisciplinary AI programs through a "cluster hiring" approach, including with tenure tracks for teaching faculty. Institutions could also deliberately seek to hire people working at the intersection of AI with other disciplines. Departments could share resources across departments and bring in faculty with joint appointments. IHEs could incentivize AI + X teaching and scholarship by actively rewarding such collaboration and transdisciplinary efforts.

Several ideas for AI training and professional development for existing faculty also arose. Participants suggested that IHEs seek opportunities to train faculty in various disciplines about AI concepts and potential intersections with their fields—for example through boot camps, residence programs, clinics, or short courses geared towards a particular discipline. These or other types of faculty training events could be made fun and engaging, potentially with refreshments and opportunities to meet colleagues working in different disciplines, and could each be designed around a single AI topic, such as prompt engineering. Another approach could be to leverage an IHE's education faculty to help develop relevant AI education geared toward faculty in other disciplines.

In addition to being educators, faculty can fill important roles as mentors to students and to each other. IHEs could take deliberate steps to catalyze mentorship across all faculty levels to help build AI educational capacity. If faculty time is limited, postdoctoral researchers or other students could serve as mentors to students of interdisciplinary AI. Similarly, doctoral students with appropriate technical backgrounds could be enlisted to serve as AI teaching assistants to students in X courses, or provide lectures on relevant AI concepts to students focused on other lines of study.

6. Policy, Governance, and Partnerships

Should IHEs aim to introduce new interdisciplinary AI initiatives, they could consider establishing advisory boards and building internal support structures necessary to support associated activities. IHEs or government entities could work to establish policies to support data sharing and provide funding for interdisciplinary AI activities at IHEs. Professional associations or academic communities could be important conveners or advocates for collective brainstorming and to facilitate the sharing of ideas and best practices. Federal agencies that maintain U.S. educational statistics could create new CIP codes that reflect interdisciplinary AI degrees of relevance for the workforce. IHEs could communicate with partners from all sectors to learn about their custom AI-related workforce training needs to inform curriculum design. One participant suggested establishing a working group with industry leaders leveraging AI in their organizations to share their technical needs with IHEs.

7. Resources

Participants shared ideas for resources that could facilitate building capacity in interdisciplinary AI education across the United States. First, IHEs should identify and leverage existing resources in their efforts. IHEs can seek seed or other funding from multiple sectors—including government agencies, foundations, and industries—for example, starting with alumni.

One opportunity for establishing new resources would be to create a repository of shared course materials, perhaps via an online and open-access platform that can be leveraged at any IHE. It was suggested that interdisciplinary AI centers could aggregate AI + X training materials, potentially supported by federal agencies. Shared repositories could also include data and case studies for specific disciplines. In addition, State governments that wish to prioritize interdisciplinary AI education could launch their own initiatives to help fund such programs at IHEs.

8. Recruitment and Participation

IHE activities will require student enthusiasm and participation to succeed. IHEs, government agencies, industry, or other partners could establish scholarship programs designed to support students studying AI in the context of other disciplines. IHEs can also focus on marketing their programs to attract resources, faculty, and students. Experts in AI and other disciplines can promote the value of AI education, and policymakers and administrators can incentivize the creation of programs, courses, and other activities. Several participants suggested that AI and CS courses could be added into general education curricula across the IHE. Finally, efforts could be taken to build a pipeline of AI-savvy students by engaging K-12 learners in applied AI activities, including in core disciplinary classes such as biology, history, and others, and by incorporating AI literacy into K-12 education.

9. Ensuring That Interdisciplinary AI Programs Meet a Need

Participants also pointed to the need to understand and ensure the efficacy of new, interdisciplinary AI programs or activities. As part of the effort to build capacity in this area, IHEs or departments could establish and implement an approach for assessing the success of their AI education offerings. IHEs or other entities could also create working groups or host focus groups with students and recent alumni to assess whether they are gaining the knowledge and skills that are marketable and that are needed to succeed in their discipline today. It was also suggested that, as needs and opportunities will change over time, IHEs should actively embrace the dynamic nature of education in tailoring AI programs and activities to meet evolving student, IHE, discipline, and workforce needs.

B. Visions for the Future

Participants discussed many positive visions for the future, based on their own experiences and priorities related to AI education. In one vision, integrated AI + X degrees would be available in almost every university as a common practice. In another, AI + X programs will create an ecosystem where AI technologies enable all forms of discovery. In particular, one participant envisioned a new generation of graduates who can solve real-world engineering problems more efficiently with the help of AI tools. Other participants saw a future where learning teams are multidisciplinary, similar to the way that companies form their teams, and IHE activities increasingly involve transdisciplinary collaboration from diverse fields.

It was suggested that the future of AI education should be focused on everyone being able to use AI in their own context, with an emphasis on AI literacy, adoption, communication, and ethics. Every student in an IHE would have access to AI training if they want it, via properly designed curricula for their context. AI curricula would teach ethical and trustworthy AI. Faculty would be offered short courses on using AI in their teaching, and IHEs would provide clear guidance on safe and fair uses of AI in their institution. Education of administrators and faculty is paramount to achieve these visions.

Participants also envisioned development of new communities and organization types. For example, an established community or central authority on AI education and training AI could link programs to industry workforce needs, which may change rapidly because AI has been rapidly advancing. Another possibility is development of a consortium or community analogous to the Centers of Academic Excellence or U.S. Service

Academies that currently support workforce development for the defense and intelligence communities in areas such as cybersecurity and other critical technology areas.[7]

A community of AI + X program leaders could work collaboratively to share core goals, frameworks, and components for X-specific or general AI education and training. Related efforts have already been underway at the K-12 level, including AI4K12.org and K12CS.org. One participant shared a vision of pre-kindergarten to postsecondary education that continuously changes to prepare students for AI R&D and applications.

Participants pointed out possible changes on the horizon that IHEs, students, and other stakeholders could anticipate as the landscape continues to evolve. Several participants predicted that AI will become so pervasive and widely applicable that it becomes assumed as part of all programs' curricula, leading to fewer standalone AI + X programs in the longer term. Several phrased this in terms of all programs effectively being X + AI, with AI topics or tools included in the coursework for most majors. Broad, interdisciplinary AI education opportunities could be established either from the top down by IHE leadership, or from the bottom up as student, institutional, workforce, and national priorities change. It was also suggested that, over time, consumers, producers, and enablers of AI will diverge into separate categories as AI technologies mature and are adopted in education, research, and industry applications. One participant anticipated that AI will shape the future job market; people who know how to use AI will have the upper hand, and a major question we face is how to prepare an AI-capable U.S. workforce.

C. Conclusions and Takeaways

In the concluding session of the workshop, participants shared final insights and reflected on discussions held over the sessions. One particular idea conveyed by multiple participants was the growing interest in designing AI + X programs for universities to remain at the forefront of research and student engagement. One participant noted that interest in AI is diverse and fast-growing, with integration of AI into many disciplines still in its formative stage. Many institutions are adapting quickly, though structural challenges remain, including tuition distribution models that complicate cross-departmental collaboration.

There was little consensus on what an AI + X or X + AI education will or should look like, but participants generally noted that tailored approaches based on disciplinary context and student needs are required. Ultimately, participants indicated strong interest in taking what they had learned from the workshop back to their individual institutions and an

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[7] See, for example, https://www.nsa.gov/Academics/Centers-of-Academic-Excellence/ and https://www.dni.gov/index.php/iccae

earnest desire to continue to develop interdisciplinary AI educational opportunities at IHEs and beyond.

7. Wrap-Up and Next Steps

Upon conclusion of the major discussions, workshop facilitators thanked NSF staff for supporting workshop planning and implementation and for hosting the event, Professor Li Wang of Syracuse University for providing travel stipends and meals for participants, and all participants for their active engagement. Participants agreed to summarization of their discussions without direct attribution of remarks for public release, so that others may also learn from the proceedings.

Appendix A.
Workshop Agenda

Day 1: March 11, 2025

9:00-9:15 AM	**Opening Remarks**
9:15-9:45 AM	**Introductions**
9:45-11:15 AM	**Breakout Sessions: Defining and Scoping AI Education Across Disciplines**
11:15-11:30 AM	Break
11:30-12 PM	**Report-Out**
12-1 PM	Lunch Break
1:00-2:30 PM	**Breakout Sessions: Designing AI Programs and Activities Across Disciplines**
2:30-2:45 PM	Break
2:45-3:15 PM	**Report-Out**
3:15-4:30 PM	**Breakout Sessions: Resources and Strategies for Implementing and Sustaining AI Educational Programs and Activities**
4:30-4:55 PM	**Report-Out**
4:55-5 PM	**Day 1 Wrap-Up, Plans for Day 2**

Day 2: March 12, 2025

9:00-9:30 AM	**Opening Remarks and Recap of Day 1 Outputs**
9:30-11:30 AM	**Charette Session: Barriers and Enablers to Designing, Implementing, and Sustaining AI Educational Programs or Activities Across Disciplines**
11:30-12:30 PM	Lunch Break
12:30-1:15 PM	**Report-Out on Barriers and Enablers**
1:15-1:30 PM	Break
1:30-3:00 PM	**Lessons Learned, Promising Practices, and the Future of AI Education Across Disciplines**
3:00-3:15 PM	**Wrap-up and Next Steps**

Appendix B.
Workshop Discussion Questions

Session One: Defining and Scoping AI Education Across Disciplines

- What do you consider to be included in "AI Education Across Disciplines"? How do you define this area?
- What programs or activities of this sort have been implemented at your institution of higher education (IHE)?
- What gaps or needs exist (or existed) at your institution that motivated creation of these programs or activities?
- What other gaps, needs, or motivations might be relevant for other disciplines, or other IHEs?
- What is the value or benefit of these programs or activities?

Session Two: Designing AI Programs and Activities Across Disciplines

- How did you decide what type of program to create and how to structure the program?
- What were some crucial factors and conditions you needed to consider when you designed your AI + X program/activity?
- What educational outcomes do you want for your students and why?
- What specific learning goals, activities, courses, topics, or lessons are critical to your program and why? What prerequisites are required?
- To what extent are interdisciplinary programs or activities distinct from core AI or traditional programs in that discipline?

Session Three: Resources and Strategies for Implementing and Sustaining AI Educational Programs and Activities

- How do you recruit and engage students?
- What major resources are needed to implement and sustain AI educational programs and activities across disciplines?
- How did you (or might others) secure these resources?

- How have you had (or how might you need) to adapt your approach to implementing the program from what you originally designed?

Session Four: Enablers and Barriers to Designing, Implementing, and Sustaining AI Educational Programs or Activities Across Disciplines

- **Objective:** Identify known or potential barriers and enablers to successfully increasing educational capacity in AI across disciplines, and opportunities that could increase the number of students participating.
- **Process:** Participants rotate from topic to topic in 4 rounds and collaboratively develop and build on each other's content

Session Five: Lessons Learned, Promising Practices, and the Future of AI Education Across Disciplines

- What are actionable ideas for building AI educational capacity across disciplines?
- What vision do you have for the future of AI education across disciplines in U.S. IHEs? How can this vision be achieved?
- What is one thing that surprised you, or that you learned, that you will take back with you to your institution after this workshop?

Appendix C.
Participant Biographies

Participant Biographies
Stella Batalama serves as the Dean of the College of Engineering and Computer Science at Florida Atlantic University since Aug. 2017, and is a member of the faculty of the Electrical Engineering and Computer Science Dept. Previously (1995–2017), she served on the faculty of the University at Buffalo, SUNY. She was a member of the University at Buffalo Faculty in Leadership Program, Associate Dean for Research in the School of Engineering and Applied Sciences (2009–2011), Interim Chair of Electrical Engineering (2010–2011), and Chair of Electrical Engineering (2011–2017). From 2003 to 2004, she was the Acting Director of the Air Force Research Laboratory Center for Integrated Transmission and Exploitation, Rome NY, USA. Her research interests include cognitive and cooperative communications and networks, multimedia security and data hiding, underwater signal processing, communications and networks. She has published over 190 papers in scientific journals and conference proceedings in her research field. She was a recipient of the 2015 SUNY Chancellor's Award for Excellence in Research and served as an Associate Editor for the IEEE Communications Letters (2000–2005) and the IEEE Transactions of Communications (2002–2008). She was educated at the University of Virginia (Ph.D. electrical engineering), Harvard Business School (PLD, executive business) and University of Patras, Greece (BS/MS, Computer Science and Engineering).
Mary S. Bell, Dean, the Beacom College of Computer and Cyber Sciences at Dakota State University. Dean Bell leads academic innovation at Dakota State University, strategically developing programs from certificates to doctoral degrees in AI, Cyber Operations, and Quantum Computing. She emphasizes interdisciplinary curricula, faculty mentorship, and industry partnerships to create robust research and experiential learning opportunities. Previously, she served as a professor and department chair at the National Defense University, guiding graduate-level education and designing cyberspace and intelligence courses. Her 20-year Army career included flying UH-60 Blackhawks, C-12 Hurons, and EO-5 reconnaissance aircraft, commanding missions across Korea, Haiti, Central and South America, and Iraq, and negotiating international agreements under the Open Skies Treaty. She also taught military strategy at the U.S. Air Force Academy. Her expertise spans cybersecurity, operational art, intelligence integration, and strategic analysis, with current research interests in AI, quantum computing, and workforce development. She holds a Ph.D. in International Studies from Old Dominion University and has extensive experience bridging academia, government, and industry.

Participant Biographies

Huiping Cao is a Professor of Computer Science at New Mexico State University (NMSU). She obtained her PhD from The University of Hong Kong (HKU) in 2007. Dr. Cao's research interests are in data sciences, particularly in data mining, big data, and applied machine learning. Her work focuses on developing effective and efficient computational methods for extracting valuable knowledge from complex data, such as sequences and graphs, through both predefined mining tasks and ad-hoc queries. Her work has been sponsored by multiple NSF and DoD awards. She has published over 60 peer-reviewed research articles in highly competitive venues. Dr. Cao has actively contributed to the academic community as a conference organizer, journal reviewer, and (senior) program committee member for numerous international conferences. Currently, she serves as the Associate Department Head of her department.

Ebrahim Fathi is an Associate Professor at West Virginia University and a leading expert in sustainable energy solutions. With extensive hands-on experience in Carbon Capture, Utilization, and Storage (CCUS), Engineered Geothermal Systems, AI-driven data analytics, hydraulic fracturing, and unconventional reservoir development, Dr. Fathi's work is at the forefront of innovative energy solutions. Fathi has led multiple funded research projects supported by RPSEA, DOE/URS, DOS, Leidos, NETL, and EQT Production Company, focusing on cutting-edge advancements in subsurface energy technologies. His expertise extends to the application of AI-driven data analytics in developing and monitoring subsurface carbon storage, geothermal reservoirs, and unconventional oil and gas resources. Dr. Fathi's contributions are widely recognized through his acclaimed books, numerous journal publications, and prestigious honors, including the AIME Rossiter W. Raymond Memorial Award and the SPE Outstanding Technical Editor Award.

Dr. Dhan Lord B. Fortela is an Assistant Professor at the Department of Chemical Engineering at the University of Louisiana at Lafayette, specializing in AI/ML applications in Chemical Engineering. He earned his BS in Chemical Engineering from the University of the Philippines, Los Banos (2010) and his PhD from the University of Louisiana at Lafayette (2016). He also completed post-doctoral training in Statistics and Data Science through MITx. Dr. Fortela's research spans biofuel production, sewage sludge to lipids, green chemistry, bioprocessing, computational modeling, and AI/ML applications. His early-career research involved the production of fuels and chemicals from wastewater streams. His current projects focus on the application of AI/ML techniques to solve traditional and emerging problems in chemical engineering and related engineering systems. He has a scholarly h-index of 10 and over 1200 citations currently. He has held various academic positions, including Instructor at the University of the Philippines (2011–2012), and Research Scientist (2016–20219) and Instructor (2019–2024) at the University of Louisiana at Lafayette. Dr. Fortela is an active member of the American Institute of Chemical Engineers and serves as the Chief-Advisor of the Louisiana-Delta Chapter of Tau Beta Pi - The Engineering Honor Society.

Participant Biographies

Lawrence O. Hall is a Distinguished University Professor in the Department of Computer Science and Engineering at the University of South Florida and co-Director of the Institute for Artificial Intelligence + X. He received a Ph.D. in Computer Science from Florida State University (1986) and a B.S. in Applied Mathematics from Florida Institute of Technology (1980). He is a fellow of the IEEE, AAAS, AIMBE, IAPR, and AAIA. He received the 2021 Fuzzy Pioneer award from the IEEE CI Society. He received the Norbert Wiener award in 2012 and Joseph Wohl award in 2017 from the IEEE SMC Society. He was the IEEE VP Publications 2021–2. A past President of the IEEE Systems, Man and Cybernetics Society, former EIC of what is now the IEEE Transactions on Cybernetics. He is on the editorial boards of the Proceedings of the IEEE and IEEE Spectrum. His research interests lie in learning from big data, distributed machine learning, medical image understanding, bioinformatics, pattern recognition, modeling imprecision in decision making, and integrating AI into image understanding. He explores un and semi-supervised learning using scalable fuzzy approaches. He's authored or co-authored over 100 publications in journals and many conference papers and book chapters.

Dr. Daniela Jones is an Assistant Professor in the Biological and Agricultural Engineering Department at North Carolina State University and holds a joint-faculty appointment with Idaho National Laboratory (INL). She also serves as the Data Science Academy Director of Agricultural Analytics, Graduate Faculty of the Operations Research Program, and a Faculty Fellow of the Center for Geospatial Analytics. Dr. Jones's research focuses on decision intelligence, machine learning, hyperspectral satellite imagery, operations research, and geospatial analytics to advance sustainable agriculture and energy systems. Her projects include optimizing supply chains for sustainable aviation fuels, analyzing in-season sweet potato yields, and mapping crop residue and tillage intensity using satellite imagery and multi-year data. She collaborates extensively with economists, computer scientists, breeders, energy policymakers, and industry partners like Scott Farms, Farm Pack, and Nash Produce, as well as national labs and agencies such as INL, Oak Ridge National Laboratory, USDA, and USGS. She developed and leads the Agricultural Data Science Graduate Certificate Program, which integrates expertise from multiple colleges and serves as a key platform for workforce development in agricultural analytics. As of January 2025, the program has graduated 17 students and enrolled 20 more from diverse disciplines. Additionally, Dr. Jones is co-developing USDA-funded open-source modules on AI, robotics, and digital agriculture for the upcoming course “Disruptive Ag Tech & Business Models”, reinforcing her commitment to innovative agricultural education.

Participant Biographies

Scott A. King is a professor of Computer Science at Texas A&M University – Corpus Christi. He has been teaching computer science for close to 30 years at various institutions. He has developed or coordinated BS, MS and doctoral programs, has been a department chair, and investigator in many educational projects. He is member of AI2ES (NSF AI Institute for Research on Trustworthy AI in Weather, Climate, and Coastal Oceanography) and is part of leadership for AI education and workforce development. He is also a co-lead of the Southwest Region of CAHSI (Computing Alliance of Hispanic Serving Institutions, an NSF INCLUDES Alliances). AI2ES and CAHSI are particularly interested in bringing computing and AI to a larger audience with efforts aimed at two-year, four year, and graduate programs.

Dr. Cengiz Koparan has 8 years of experience in higher education teaching, research, outreach, and service activities in precision agriculture technologies, agricultural robotics, and agricultural sciences. He specializes in research and teaching in Unmanned Aerial Vehicle (UAV) and Unmanned Ground Vehicle (UGV) with a focus of automating agricultural systems for improved data driven precision farming. Dr. Koparan published UAVs and Agricultural Machine Systems related peer-reviewed research articles in high-ranking journals both as first author and co-author. He serves in graduate committees, presented his research at departmental seminars, mentored graduate, and undergraduate students, co-advised student robotics clubs, co-authored peer-reviewed research articles, created lesson plans for sophomore and junior level courses and delivered. In addition to his research training and experience, his education in business management and experience gained during his postdoctoral responsibilities would enhance his effectiveness in proposed activities.

Chad H. Lane is a Professor of Educational Psychology and Computer Science at the University of Illinois, Urbana-Champaign and serves as the PI and Director of the NSF-IES INVITE AI Institute. Chad's research focuses on the design, use, and impacts of intelligent technologies for engagement, interest development, and learning. This work involves blending techniques from the entertainment industry (that foster engagement) with those from artificial intelligence and intelligent tutoring systems (that promote learning). He has over 120 publications in a variety of areas, including intelligent tutoring, pedagogical agents, educational games, and computer science education. Lane was recognized in 2023 with the UIUC College of Education's Distinguished Senior Scholar Award and Outstanding Faculty Award for Public Engagement. His PhD is in Computer Science from the University of Pittsburgh (2004), and prior to joining UIUC, he spent ten years as a research scientist and Director of Learning Sciences Research at the USC Institute for Creative Technologies in Los Angeles, CA.

Participant Biographies

Dr. Yi Lu Murphey received an M.S. degree in Computer Science from Wayne State University, Detroit, Michigan, USA, and a Ph.D. degree in Computer Engineering from the University of Michigan, Ann Arbor, Michigan, USA. She is currently the Paul K. Trojan Collegiate Professor of Engineering at the University of Michigan-Dearborn. Dr. Murphey served as the Chair of the Department of Electrical and Computer Engineering for eight years and as the Associate Dean for Graduate Education and Research at the College of Engineering and Computer Science for six years at the University of Michigan-Dearborn. Her research interests include machine learning, artificial intelligence, pattern recognition, and computer vision, with applications in automated driving, connected vehicles, optimal vehicle power management, driver behavior analysis and prediction, and intelligent systems for detecting cognitive declining. Dr. Murphey's research has been funded by government agencies and industry, including the National Science Foundation (NSF), the National Institutes of Health (NIH), the Department of Energy (DoE), the U.S. Army, the State of Michigan, Ford Motor Company, ZF-TRW, and Nissan. She has authored over 200 publications in refereed journals and conference proceedings. She is a fellow of IEEE, a Distinguished Lecturer for both IEEE Vehicular Society and IEEE Computational Intelligence Society.

Rebecca Nugent is the Stephen E. and Joyce Fienberg Professor of Statistics & Data Science and Head of the Carnegie Mellon Department of Statistics & Data Science. Dr. Nugent is currently on the leadership team for the NSF AI Institute for Societal Decision Making and has expertise in designing and implementing data science/AI professional development programs for industries including health care, finance, automotive, manufacturing, and life sciences, including the Moderna AI Academy. Dr. Nugent is one of the co-founders of the Carnegie Mellon Sports Analytics Center, now in its seventh year of supporting cutting edge research, sports analytics training and educational programming, and the development of diverse pipelines into related industries and graduate school programs. She also serves as the PI for the NSF-funded SCORE with Data project, a national initiative incorporating best pedagogical practices in data science and sports analytics. She has won several national and university teaching awards including the American Statistical Association Waller Award for Innovation in Statistics Education and serves as one of the co-editors of the Springer Texts in Statistics. She served as the co-chair for the National Academy of Sciences study on Improving Defense Acquisition Workforce Capability in Data Use and served on the NAS study on Envisioning the Data Science Discipline: The Undergraduate Perspective. Dr. Nugent has worked extensively in clustering and classification methodology with an emphasis on high-dimensional, big data problems and record linkage applications. Her current research focus is the development and deployment of low-barrier data analysis platforms that allow for adaptive instruction and the study of data science as a science.

Paul A. Salvador is a Professor of Materials Science and Engineering at Carnegie Mellon University and is the Director of the professional Master's program "Energy Science, Technology & Policy." His research focuses on: (1) designing heterostructures for sustainable fuel production, (2) understanding performance of materials in electrochemical cells for advanced energy systems, (3) developing high-throughput methodologies for epitaxial stabilization of new materials, and (4) designing materials and systems for direct air capture and carbon conversion. His group develops advanced and high-throughput methods to fabricate, characterize, and simulate materials, often integrating ML and AI methods. Professor Salvador received his B.S.E. in MSE from the University of Pennsylvania in 1992 and his Ph.D. in MSE from Northwestern University in 1997. After spending two years as a post-doctoral researcher and Chateaubriand Fellow at the École Nationale Supérieure d'Ingénieurs de Caen, working at the Laboratoire de Crystallographie et Sciences des Matériaux, he joined CMU in 1999. He was promoted to an Associate Professor in 2004 and to a professor in 2008. He spent two months in 2011 as an Invited Professor at Université de Caen Basse-Normandie. Since 2018, he has been directing the EST&P program for the College of Engineering at CMU.

Dr. Ebrahim Tarshizi is Professor of Practice and Director of the MS in Applied Data Science (ADS) and MS in Applied Artificial Intelligence (AAI) programs at the University of San Diego (USD). He is also the director of the Center for Digital Civil Society in the Shiley-Marcos School of Engineering. Ebrahim is a member of a startup company's advisory board specializing in healthcare technology. He was an Adjunct Professor at National University, where he has taught a variety of business and data analytics courses. He is a former senior technical advisor for the CDC National Institute for Occupational Safety and Health's (NIOSH) Mining Research Program. He was an instructor for the UCSD Extension's Business Intelligence Analysis program. Ebrahim was a visiting scholar at UCSD's San Diego Supercomputer Center (SDSC) and an Assistant Professor at Michigan Tech, where he spent over two years to co-develop a new engineering curriculum. Ebrahim received a Ph.D. in Geo-engineering from the University of Nevada, Reno (UNR). He obtained an MSc. in Data Science from Michigan Tech and an MBA from UNR College of Business. He earned a BSc. in Exploration Engineering in Iran. Ebrahim has published several articles in international journals and symposium proceedings and has delivered many technical reports and presentations at professional meetings and conferences. He has received a number of university, national, and international awards and honors.

Participant Biographies

Blair Taylor is the Director of the Center for Interdisciplinary and Innovative Cybersecurity (Cyber4All) and a Professor in the Department of Computer and Information Sciences at Towson University. A nationally recognized expert in cybersecurity education and curriculum development, Dr. Taylor worked with NSA's College of Cyber as a Subject Matter Expert to develop long-term strategies for expanding the pipeline of qualified cybersecurity professionals and strengthening the nation's cyber workforce. Currently, Dr. Taylor leads the NSF/NSA Cyber AI project, a national initiative to develop and pilot Knowledge Units and an AI Program in Cybersecurity (CyberAI) for the NSA Center of Academic Excellence (CAE) in Cyber program. Other initiatives include CLARK (clark.center), the largest platform offering free cybersecurity curriculum; Security Injections @ Towson, which provides security modules for integrating security concepts across various disciplines; and the National Cybersecurity Curriculum Taskforce. In addition to her academic leadership, Dr. Taylor serves as Co-Executive Director of SecurEd, a not-for-profit startup dedicated to helping academic institutions build a cyber-ready workforce. She holds a B.A. in Mathematical Science and an M.S. in Computer Science from Johns Hopkins University, as well as a doctorate in Applied Information Technology from Towson University.

Dr. Huihui Wang is a Full Teaching Professor and Director of Computing Programs of Khoury College of Computer Sciences at Northeastern University in Arlington VA in July 2024 after she rotated out of the NSF where she worked as a Program Director. Prior to the NSF, she worked with St. Bonaventure University as a Tenured Associate Professor and Director of Cybersecurity Programs and she was the Founding Department Chair of Engineering at Jacksonville University. Her current research interests focus on 1) AI powered Cyber-Physical Systems/Internet of Things; 2) Computing and Engineering Education. She has published over 100 peer reviewed journal and conference papers and published four patents. Dr. Wang is a member of Association for Computing Machinery, and American Society of Engineering Education (ASEE) and a senior member of Institute of Electrical and Electronics Engineers (IEEE). She is a member of the Board of Governors IEEE Education Society (2024–2026), a member of ASEE Board of Directors and the Chair of Professional Interest Council IV (2025–2028), and was a member of IEEE Educational Activities Board. Dr. Wang is a program evaluator under both Engineering Accreditation Commission and Computing Accreditation Commission of Accreditation Board for Engineering and Technology.

Participant Biographies

Dr. Jinjun Xiong is Empire Innovation Professor with the Department of Computer Science and Engineering at University at Buffalo (UB). He also serves as the Scientific Director for the $20 M National AI Institute for Exceptional Education, the AI lead for the $10 M IES Center for Early Literacy and Responsible AI, and Director for the UB Institute for Artificial Intelligence and Data Science. Prior to UB, he was a Senior Researcher and Program Director for AI and Hybrid Clouds Systems at the IBM Research. He co-founded and co-directed the IBM-Illinois Center for Cognitive Computing Systems Research (C3SR) in 2016, the success of which led to the 10-year $200M expansion of C3SR to the IBM-Illinois Discovery Accelerator Institute in 2021. His research interests are on end-to-end AI systems research, including AI applications, algorithms, tooling and computer architectures. Many of his research results have been adopted in IBM's products and tools. He published more than 160 peer-reviewed papers in top AI conferences and systems conferences. His publication won 9 Best Paper Awards and 10 Nominations for Best Paper Awards. He coined the term "Earthly AI" in 2019 to emphasize the importance of developing AI to address societal challenges.

Abbreviations

AI	artificial intelligence
CAE	Center of Academic Excellence
CIP	classification of instructional program
CS	computer science
GPUs	graphics processing units
HPC	high-performance computing
IDA	Institute for Defense Analyses
IHEs	institutions of higher education
IP	intellectual property
NAIRR	National AI Research Resource
NCAE-C	National Center for Academic Excellence in Cybersecurity
NSF	National Science Foundation
OSTP	Office of Science and Technology Policy
STPI	Science and Technology Policy Institute

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14. ABSTRACT
On March 11–12, 2025, the U.S. National Science Foundation hosted a workshop on Building AI Educational Capacity Across Disciplines. This workshop was conducted as a follow-up to efforts of NSF to assess Federal artificial intelligence (AI) workforce, culminating in a 2024 report to Congress that identified master's-level graduates and expertise in AI combined with fields of relevance to agency missions. The goal of the workshop was to gather insights on approaches to building educational capacity in this area at U.S. institutions of higher education (IHEs). STPI researchers assisted in planning and coordinating the workshop, including compiling this summary report of key discussion points.

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artificial intelligence (AI); educational capacity; institutions of higher education (IHEs)

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