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The Role of Artificial Intelligence in Advancing Student Success: Perspectives from Three Land Grant Institutions

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Abstract

In this work, the authors will describe and outline the wide spectrum of areas that their respective large public land grant universities are investing in with efforts towards the utility of artificial intelligence (AI) and generative AI to satisfy the overarching mission of universities with very high research activity. As part of this work, institutional approaches taken towards formulation of policies and procedures for classroom use will be compared and contrasted. Additional approaches made for overall academic purposes will also be addressed. One additional unique role at public land grant institutions is the role of extension offices, and how they serve the citizens of their states, specifically where there may be opportunities to leverage AI towards satisfying their mission.

Many institutions nationwide are developing academic programs in AI. The simplest methodologies include the development of courses across various academic colleges, which are often extended to form credentials, certificates and concentrations. Some institutions have created minors or degrees at the undergraduate and graduate level. Faculty have discussed and may have had to develop new synergies/interactions between these new programs and existing programs. Another approach is incorporating AI Literacy into curricula.

There are many opportunities for broad-based research about and using AI. For example, the role of machine learning, artificial intelligence and data science in academic research is of critical importance. Furthermore, the evolution of research computing resources (aka CPU vs GPU balance), data repositories, data management policies and data accessibility are central to an academic institution and often involve fostering relationships between academic colleges, research divisions and university libraries. Furthermore, there are amazing opportunities for campus communities to create, develop and stand-up consultation services to enable faculty to incorporate AI into their research methods, and to train students how to use AI-powered research tools to expedite and enhance information discovery. Research in generative AI is also being conducted at these institutions and will be outlined. With regard to application in academic settings, this includes the development of institutional chatbots and research using AI teaching assistants.

This work will also describe support of other university initiatives. For instance, the development of chatbots for use by prospective/current students, the use of chatbots to support employees (faculty, staff), or unique approaches such as the use of AI to support other institutional business/finance functions. Finally, this work will also address how institutions are providing outreach to the local community through workshops, applied learning experiences for students, and other engagement activities.

Introduction and Background

The authors all have an interest in AI as applied to improving student success and in supporting research across their respective land grant institutions (Iowa State University, Kansas State University and Mississippi State University). Over the last couple of years, our institutions have formulated, from the ground up, policies and procedures regarding appropriate use of AI. We have discussed these procedures and shared topics of mutual interest in passive conversation, so in some ways individual institutional policies were informed by decisions being made at their sister institutions. Based upon these mutual interests, this paper is being assembled to compare and contrast directions being made and to share lessons learned and best practices with the engineering education community as a whole. Furthermore, institutions who are developing, revising and/or refining their AI policies may find the information contained within this article of interest.

Artificial Intelligence (AI) is impacting daily life, especially within higher education. Faculty worry about the likelihood of student cheating [1] and have seen a growth in academic integrity filings since the advent of ChatGPT. In fact, [2] points to a Stanford University survey where 1/6th of students said they had used ChatGPT on assignments or exams. This article [2] also points towards the issues of hallucinations, where AI focuses on generating text that sounds good but may not be scientifically accurate. However, [1] also points to potential efficiencies and utility of AI in higher education, such as teaching ethical use of AI, growth of tutoring/teaching assistants and for operational efficiencies. Auon [3] discussed the impact of AI on the human experience in physical (personalized medicine/drug delivery and disease identification), cognitive (increased workplace productivity, focused effort on higher level/strategic tasks and digital twins) and social (via AIenabled virtual reality) areas.

Inside Higher Ed [4] conducted a survey of chief technology officers and showed that only 9% of respondents feel higher education is ready for the rise of AI. Furthermore, slightly more than 30% of CTO's felt that their institution was prepared, and nearly half felt that they were ready to tackle the increased reliance on AI. Articles that point towards similar surveys [5-7] show that although there is near universal acknowledgement that AI can positively impact education [6], Carnegie Learning's survey [7] found that only 77% think AI is useful. There is still a utilization gap, as only 56% are using it. Factors that impact adoption of these tools [8] in the curriculum include anxiety [9], self-efficacy [10], attitude, perceived ease of use/technology acceptance [11] and perceived usefulness. Furthermore, there is evidence that suggests that as the number of instructional technologies available at institutions grow, faculty are less likely to use them [12] due to lack of interest/capacity to use the tool, self-efficacy and personal ideals in pedagogy. Trouble points in utilization include underestimating the complexities of using any new technology including formulation of instructor comfortability and knowledge as well as the time required to deliver courses using different technology platforms [13-15].

Schroeder [16] recently projected a short-term vision of AI in higher education, including using AI towards decision making in admissions, financial aid, finance, scheduling and human resources. Within the classroom, there are opportunities for advanced AI models to aid in the teaching enterprise (with faculty/department chair oversight). Furthermore, autonomous robots may play a role in services such as libraries, dining halls and facilities and operations.

Within STEM disciplines, there are additional opportunities and challenges associated with using AI tools [17]. Doors are opened to facilitate teaching and learning through simulations as well as in providing personalized tutoring/instruction. Concerns arise from the impact on the learning process when tools like ChatGPT can compose text to be used to write essays, conduct literature reviews, etc. The emphasis on memorization may become even less important as apps and other tools will exist to retrieve information in appropriate formats. This also creates opportunities for pushing forward through scenario/systems thinking. Forbes [18] points current students towards resources that may allow them to use tools, including AI, to prepare them with skills needed to enter fast growing job markets. In the last two years, advancements in Artificial Intelligence (AI) have revolutionized the landscape of higher education. Consequently, there have been large dialogues across all of higher education in the formulation of academic policies about AI. This centers specifically around the utilization of AI towards enhancing student learning, the incorporation of AI policies into course syllabi, as well as the role of ethics in teaching about AI in STEM and in non-STEM fields. Furthermore, there are varying philosophies and approaches towards supporting the use of AI in the classroom. These include leveraging resources and skill sets of personnel inside of academic writing centers, the creation of faculty / staff positions in university libraries (aka AI-brarians), institutional wide decisions that create and foster internal incentives to promote innovation in applying AI to teaching, support for the development of online resources (tutorials, books, examples) to help faculty revise or develop courses that leverage AI, support for professional development (e.g., taking Coursera courses, attending training institutes, reducing teaching load temporarily) and university libraries using AI tools in metadata and discovery.

After outlining some high-level information about our institutions, we will address our efforts, comparing and contrasting initiatives and institutional priorities revolving around AI, as it applies towards academic policies, courses and curricula and research. There are other areas that AI is impacting at our universities, but these three are most relevant to this publication venue. As land grant universities, our student-focused teaching, fundamental and applied research, and outreach missions have all been enhanced by access to AI.

In fall 2024, Iowa State University (ISU) enrolled 30,432 students spread across seven academic colleges. This enrollment included 25,628 undergraduate, 4,170 graduate and 634 professional students. Of this total, 53% were Iowa residents and nearly 61% were enrolled in a STEM major. Female students accounted for nearly 45% of the undergraduate population, over 44% of the graduate students, and over 83% of the professional students. Enrollments have continued to

increase in business and in engineering. The university reported over $420MM in research and development expenditures in the FY 2023 Higher Education Research and Development survey. The university's mission is to create, share and apply knowledge to make our students, Iowa and the world better. The strategic plan is built upon four pillars: innovative solutions, education experience, community engagement and knowledge & discovery. Recently, the university announced plans to develop a half-dozen "degrees of the future" [19] including programs in digital health, integrated health sciences, game design and precision agriculture. The university continues to emphasize student success and is within reach of all-time-high first-year retention and six-year graduation rates.

In fall 2024, Kansas State University (KSU) enrolled 20,295 students across nine academic colleges and three campuses. This enrollment included 15,650 undergraduate students, 4,152 graduate students, and 493 professional students. Of this total, 67% were Kansas residents. Female students accounted for over 51% of the undergraduate population, nearly 59% of graduate students, and over 85% of professional students. The university reported nearly $218 million in research and development expenditures in the FY 2023 Higher Education Research and Development Survey. The university's mission is to foster excellent teaching, research, and service that develop a highly skilled and educated citizenry necessary to advance the well-being of Kansas, the nation, and the international community. The strategic plan identifies six priorities: academic innovation, workforce development, student experience, research and discovery, engagement, and economic development. It also describes four focus areas that represent strengths and opportunities for growth: community health and well-being, sustainability, global food security and biosecurity, and enabling technologies, with a particular emphasis on artificial intelligence. Over the past 10 years, both 4-year and 6-year graduation rates have steadily increased, placing the university in a strong position to meet its targets of 55% and 75%, respectively, by 2030.

In fall 2024, Mississippi State University (MSU) enrolled 23,150 students across eight academic colleges and three campuses. This enrollment included 18,567 undergraduate students and 4,583 graduate students (including professional students and educational specialists). The enrollment is nearly 52% female and includes 16.2% Black (which leads our peer institutions in 2024 in the Southeastern Conference [SEC]), 4.7% Hispanic, 3.6% Asian and 2.6% Multiracial students. It is noted that over slightly one third of undergraduates have self-reported as first-generation students. In the 2023-2024 academic year, MSU awarded 5,815 total degrees with 4,323 bachelor's degrees, 1,177 master's degrees, 51 educational specialist degrees, 169 doctoral degrees, and 95 professional degrees. The university reported nearly 340.00 million in research and development expenditures in the FY 2023 Higher Education Research and Development Survey. The university's mission as a large land grant institution is to provide comprehensive education to the citizens of Mississippi and conduct world-class research.

Academic Policies

At Iowa State University, an institutional AI committee was assembled in summer 2023 in order to guide an institutional AI strategy. The general principles of the committee are to purposely support the role of AI within each department at the university; to evaluate current AI capabilities and identify shortcomings; to develop policies and procedures for the role of AI; to develop a set of institutional priorities associated with AI; and to assess and improve performance. There are five subcommittees to address policy; teaching and learning; research; communications; and operational efficiencies. In addition, nearly two dozen employees serve on an AI committee organized out of the ISU Information Technology Services office [20].

During fall 2024, ISU's Center for Excellence in Learning and Teaching [21] center performed a survey to assess faculty perspectives on generative AI utilization in the classroom. Several questions were asked using various Likert scales. Nearly half of the respondents felt that using generative AI to support student learning was somewhat positive or very positive. There was a significant, but not a majority of faculty who currently use generative AI (GAI). About half of those who currently do not use it plan to in the future. Interestingly enough, faculty feel they need more preparation to be able to help students use generative AI. There is demand to obtain training to support their course preparation and development. Furthermore, over half of faculty AI users want students to learn generative AI skills. Faculty are also using it to develop materials for their courses. Over half use ChatGPT or Microsoft Copilot for text-based use and DALL-E and Canva for media generation. Finally, faculty who do not intend to ever use GAI feel that it is unethical, discourages learning and skill building, or that it does not fit their discipline.

The Center for Excellence in Learning and Teaching has an AI in Teaching website as a central repository which includes a Generative AI in Education course for faculty [22], which gives background information on the development of machine learning tools to mimic human learning, outlines capabilities of GAI, and describes how it can impact – and hopefully improve – teaching and learning. The course has a handful of modules including an overview of what GAI is all about (including the role of data in AI and how AI learns); the challenges it may pose for humans (with topics such as implications for human learning; how it can be managed, monitored and evaluated in the classroom); and a case study of how it can support teaching.

Through ISU's Dean of Students office [23], the Office of Student Conduct [24] provides a tutorial on academic integrity. A portion of this tutorial defines unauthorized assistance, discusses AI tools and study sites and defines unauthorized collaboration and/or teamwork. This portion underscores faculty expectations that students' work is their own and that students do not assist their classmates in academic misconduct or in resubmitting graded work in multiple courses. A later section outlines falsification and fabrication of data, falsely recording attendance and citing fictitious resources. This is emphasized here as ChatGPT, like other AI bots [2], has been known to "hallucinate" and generate references that do not actually exist.

ISU's Center for Excellence in Learning and Teaching also offers some draft syllabus language [25] as a faculty resource. In addition to providing other required language for course syllabi and academic integrity, it includes a companion site containing specific language with respect to the use of GAI [26]. Different scenarios are outlined, including when content generated by AI is not allowed; when content generated by AI is allowed but with attribution; when content is allowed but under certain instances; and when content is allowed and encouraged broadly. This language also outlines circumstances by which a student could face charges of academic misconduct. Additional resources available include a syllabus checklist that outlines required, recommended and additional statements. This includes a section on AI usage.

Meanwhile, KSU's Teaching & Learning Center encourages, but does not require, instructors to include an AI policy statement in their course syllabi. In advance of the Fall 2023 semester, they created a web page [27] with example statements organized into three categories: those permitting students to use AI, those prohibiting its use, and those requiring that students use it.

Each year the Teaching & Learning Center grants an award to one faculty member who will conduct a year-long research program related to the scholarship of teaching and learning. In October, the faculty member who received the award for the 2024-2025 academic year surveyed all teaching faculty at the university to learn how they are using GAI to support student undergraduate learning [28]. He plans to use the results to develop an inventory of expertise by department and program and to create an online resource to help spread best practices.

KSU's Teaching & Learning Center also offers a weekly professional development series to help faculty and graduate students become better teachers, mentors, and advisors. The series includes formal presentations and informal teaching chats. Over the past two years there have been three presentations focused on GAI: "Artificial Intelligence in Higher Education: A Primer (GPD);" "Teaching with AI: A Plan to Adapt & Innovate your Teaching this Year;" and "Teaching with AI: Best Practice Examples for Continued Excellence in Teaching."

After the state of Kansas issued a generative AI policy for state employees [29], KSU convened a group to develop a policy specifying how GAI can be used with university records. This group included library faculty and university-wide committees related to data governance and records management. Their draft policy [30] is undergoing review by several stakeholders.

KSU provides several AI tools to the university community. The enterprise version of the text and image generator, Microsoft Copilot is available to all faculty, staff, and students. Through its university-wide subscription to Adobe Creative Cloud, faculty can use the image generator, Adobe Firefly and several other applications, including Photoshop, into which Adobe has integrated several AI features. KSU's Salina branch campus provides its students, faculty, and staff with access to the GAI-infused writing assistant Grammarly.edu. The Sunderland Foundation Innovation Lab in the Hale Library contains an AI studio that any KSU student, faculty, or staff, as well as any resident of Kansas can use. The studio offers 13 Linux machines

and a variety of Raspberry Pi's, Arduinos, and Jetson Nanos [31]. The Linux machines are loaded with a variety of software applications that can be used to make use of AI or create AI applications. Those include two locally installed GAI applications: the image generator, Stable Diffusion, and the text generator, LLama 3.2 8b, both of which can be used without signing in. This affords KSU faculty, staff, students, as well as residents of Kansas an opportunity to explore GAI in a safe and secure setting.

In March 2023, the Provost at MSU, served as a speaker at an Association of Public and Land-Grant Universities' Council of Academic Affairs titled "The Use of AI in Teaching/Learning Environments and Degree Programs". In that same month, he charged a university Data Science committee with beginning the process of gathering feedback from faculty and staff so that all perspectives may be included in the development of AI guidelines created by a university-wide committee. In April 2023, the Provost held an Open Forum on ChatGPT at MSU for all levels of university leaders. In fall 2024, the university-wide committee vetted standardized syllabi language through the deans and Provost, and it was adopted by the Faculty Senate. The syllabi statement contends that all AI use must be approved by instructors, or it will be considered a breach of the Honor Code [32]. Discussions on establishing an institutional syllabus at ISU were held recently, but a decision was made to not formalize them at this point in time. As of now, ISU has one required and several recommended statements [25], whereas KSU also has required and recommended syllabus language [27].

MSU provides one AI tool to the university community. The text and image generator, Microsoft Copilot is available to all faculty, staff, and students with enterprise-level security and privacy.

Courses and Curricula

KSU offers a number of degrees and certificates, each requiring students to take several courses that prepare students for technical careers related to artificial intelligence. These include:

- Advanced Intelligent Systems Programming (undergraduate certificate)
- Applied Machine Learning (undergraduate certificate)
- Computer Science (Bachelor of Science, Master of Science, Doctor of Philosophy)
- Data Analytics (Master of Science, graduate certificate)
- Machine Learning and Autonomous Systems (Bachelor of Science, graduate certificate)
- Robotics and Automation Engineering Technology (Bachelor of Science)

KSU has more than 50 for-credit courses that address various aspects of artificial intelligence. The vast majority are related to robotics, data analysis or machine learning. In addition, it offers one non-credit course, which focuses on AI for sports business management [33]. Several courses related to AI are in development at KSU. These include three for-credit courses intended

to fulfill requirements for an AI and Writing microcredential through the Department of English, and a non-credit course covering use of AI for management analytics through the College of Business Administration.

In late 2023 the Provost's Office invested $1,000,000 for an internal grant program to incentivize development of innovative academic programs [34]. Two of the eight awarded proposals were for creation of AI microcredentials: one in the Department of English and one in the College of Business Administration. Those microcredentials are in development.

ISU has several academic offerings in artificial intelligence. At the undergraduate level, there is a minor in Applied Artificial Intelligence. This cross-college program has a focus on uses and implications of artificial intelligence as it relates to all facets of every industry that hires students from ISU. Students get familiarity with technologies and tools related to AI, including coding, data utilization, impacts at several levels as well as legal and ethical challenges. The minor consists of two required courses (Introduction to Applied AI and Ethical Design, Use and Impact of AI). The minor is completed with three elective courses from a list that includes courses in several departments across campus including, but not limited to anthropology, computer science, data science, economics, education, engineering, journalism, business, psychology and philosophy & religion. Newly developed courses include an English course on artificial intelligence and writing which allows students to explore how to use tools like ChatGPT to write for specific outcomes, with an emphasis on prompt generation to retrieve valuable information. The last portion of this course is the completion of a creative project (examples include a multimodal story, essay, video or even a pitch proposal for an AI-based innovation or a business plan). The Introduction to Applied AI course prepares students to understand AI’s impact on the transformation of industry and society.

ISU also offers a Master of Science in Artificial Intelligence. This is offered within the Department of Computer Science. This 30-hour degree program has a thesis track as well as a non-thesis track, which requires a creative component to graduate. There are three core required courses from computer science. Students choose an additional three courses from a list of five computer science offerings. Students are also required to select two elective courses across the university, an advanced topic course from computer science and complete a capstone/creative project under faculty supervision. The three required courses include Design & Analysis of Algorithms, Principles of Artificial Intelligence and Machine Learning.

With regard to some specific courses, all ISU undergraduates are required to take a course offered through the University Library [35] (a link to the current Open Educational Resource textbook is at [36]). This course is under regular revision, and a new version of the current course manual was significantly updated in the spring/summer to incorporate more AI. The OER will be revised in the near future. Another popular alternative that is available for ISU students and alumni has been developed by the Translational AI Center [37]: a microcredential in

translational AI. This consists of three badges: AI foundations, advanced AI and practical experiences [38].

A working group has also been formed in collaboration between ISU's Senior Vice President and Provost with the President of the Faculty Senate. This working group consists of a representative from each academic college. They are looking at ways to inform students and encourage students to consider gaining experience in artificial intelligence, and how to ethically use it in their studies and in their careers.

MSU introduced a Bachelor of Science in Artificial Intelligence in fall 2024. This built off an artificial intelligence concentration within the computer science minor (including four required core courses in artificial intelligence, AI robotics, cognitive science and machine learning & soft computing). The major in AI requires the four courses listed above as well as courses in human-computer interaction, Introduction to Machine Learning, Introduction to Analysis of Algorithms as well as one psychology course focused on cognitive science as well as four courses from a choice among electives in computer science, industrial engineering, mathematics or psychology. The emphasis on cognitive science came out of research collaborations among various departments in engineering, computer science and some humanities disciplines within arts & sciences. This unique nature also allowed for the degree to be developed with only one new course.

Additionally, at MSU, engineering students take a required technical writing/communications course as part of their degree requirements. The James Worth Bagley College of Engineering hires staff with English degrees to teach these courses. As part of the 2022-2023 academic year, the faculty worked on developing an AI policy (this was prior to the formation of institutional policies). Their syllabus policy stated:

> ChatGPT and use of AI: Unless explicitly stated otherwise, you may not use artificial intelligence-based technologies – such as ChatGPT, Socratic from Google, PepperType, Rytr, Writesonic, and R-Tutor –to generate responses for your assignments. Such use of artificial-intelligence or word-mixing software to write your paper or disguise plagiarized work is considered unauthorized assistance in this course and can lead to charges of plagiarism.

One of the more memorable dialogues held with these faculty recalled a story about a student paper. The instructor fed it into ChatGPT and asked, "Did you write this?" The response was "Yes, I wrote this."

Based upon internal discussions with the dean of students' office and engineering academic leadership, it became apparent that the Honor Code Council began seeing increased submissions of plagiarism with the advent of ChatGPT and similar generative AI tools.

More recently, an interdisciplinary research team at MSU was awarded a $1.2 million NSF grant to promote AI competencies in high school students across the state [39].

Research and Other Initiatives

Academic libraries have embraced the possibilities of AI quite quickly. At the MSU Libraries, there are many initiatives to both help guide the campus community in the ethical use of AI as well as explorations of innovations in library services, technologies and programs. For example, the Collection Management & Strategy unit is in a research and development phase for using AI in metadata creation. This will not only free up precious time of their metadata librarians but also provide a greater degree of discoverability for the libraries' resources. In addition, vendors, including Elsevier and JSTOR, are quickly adding AI-assisted search functions to their databases. The libraries were able to take part in JSTOR's free trial of their AI feature and there is consideration of adding Elsevier's upon further testing.

In summer 2024 a new position was created to lead the Libraries in AI combining it with another important function, research impact. This director-level position serves as the touchpoint for campus, liaises with the university-wide committee, and keeps abreast of developments in the field. The individual in this position started a monthly brown bag for library employees to read and discuss ongoing developments in AI. They also planned a Generative AI Day for the campus in October 2024 and partnered with faculty from diverse disciplines. Yet, there is not just one position working on AI in the Libraries. Since early 2023, there have also been training and growth opportunities at the faculty and staff levels including participation in an online SEC course "Teaching with AI in the SEC" by a library staff member. An AI LibGuide was developed in summer 2023 using expertise from across the Libraries. In addition, the subject specialists have incorporated AI literacy as part of their regular instruction sessions.

Although the reaction internal to the Libraries has been largely one of excitement and exploration, there have been several non-library faculty that have pitched the idea of having an "AI free" lab inside the library due to fears of plagiarism. This did not and will not happen, but it is important to note that the resistance to AI, particularly in the non-STEM fields, is alive and well.

The Center for Teaching & Learning (housed in the main library) and the Associate Director of the Data Science program partnered to create easily accessible videos for instructors. They also started holding regular workshops for faculty online and in the library.

KSU currently has one research center and one interdisciplinary institute with a significant amount of activity related to artificial intelligence. The Center for Artificial Intelligence and Data Science within the Computer Science Department conducts basic and applied research into topics including algorithms for data analysis, multi-agent and cooperative reasoning, knowledge representation and machine learning from temporal and spatial databases. The center currently

has nine faculty operating in eight research laboratories. The Institute for Digital Agriculture and Advanced Analytics, founded in fall 2023, is dedicated to using digital technologies and advanced analytical methods to enhance agricultural, environmental and socioeconomic decision-making [40]. Two of the institute's six directors are investigating applications of artificial intelligence to agriculture. One project is exploring how knowledge graphs can assist farmers who need to make predictions about wheat production. Another examines how AI vision systems can be used to predict crop yields based on information about seed placement during planting.

In fall 2022, the KSU Vice President for Research announced an internal grant program with $1M to fund transdisciplinary research to address complex questions [41]. One of the three funded projects addressed AI for data integration and analysis. In fall 2023 the grant program was modified to fund projects that build capacity to implement AI. Twenty-one proposals were submitted, of which five received funding. Recipients included faculty in biological and agricultural engineering, entomology, English, physics and psychology [42]. The recipient from entomology had previously led a project to develop a mobile application that uses AI-vision to identify the species to which a specific bee belongs [43].

Several colleges at KSU have launched initiatives to spread awareness of how AI can be applied to teaching, learning, and/or research. An associate dean in the College of Business Administration established a team to increase the capacity of the college's faculty to incorporate AI into their teaching. That team has presented several workshops and purchased subscriptions to several of Coursera's AI courses for faculty who wish to increase their knowledge and skills. An associate dean in the College of Engineering formed an interest group to explore how AI can enhance teaching. A faculty member in the Department of Modern Languages created a free, hybrid, three-day multidisciplinary AI symposium in fall 2023 [44]. That event's success led her to organize another symposium in fall 2024. Plans are underway for a fall 2025 symposium as well. She also assembled a team of faculty from Computer Science, English, the Libraries, Sociology and Philosophy to apply for one of NEH's Research Centers on Artificial Intelligence awards [45]. Although their 2023 application was not successful, they submitted a revision in 2024 and are awaiting word about the status of their resubmission.

Two faculty members in KSU's Department of English assembled a multidisciplinary team that successfully applied to AAC&U's year-long Institute on AI, Pedagogy, and the Curriculum [46]. The team of ten faculty and two instructional designers is developing an AI Literacy module for faculty; conducting research to better understand what materials, resources, and tools faculty need; and coordinating with administration to increase the university's capacity to benefit from AI. The same two faculty members also established an AI book club that read *Teaching with AI* in fall 2024 and is reading *Co-Intelligence* in spring 2025 [47].

KSU's Hale Library created an AI Steering Committee in spring 2023 to increase knowledge of AI across campus. The committee has created library working groups focused on AI ethics, AI in the workplace, and AI literacy. They charged each with producing a learning object or event for students, faculty and/or staff. The groups for ethics and literacy are developing online websites while the workplace group has held two online discussions open to any faculty member. The members of the steering committee have presented 12 workshops on topics including text generation, image generation, AI for resumes and cover letters, and AI-powered research tools. Each of those was advertised to the broad campus community and open to anyone to attend. Since launching a website to advertise their work [48], they have provided six workshops for extension agents, five for non-profit organizations and three for departments. They have also consulted with eight faculty who are interested in using AI to further their research. In spring 2024, at the request of the Dean of Libraries, they recruited Mutale Nkonde, the founder of the non-profit AI for the People, to present for the Libraries' lecture series.

Since spring 2023 KSU's liaison librarians for science, technology, engineering, mathematics and agriculture have provided approximately 20 guest lectures focused in-whole or in-part on the use of AI to augment research. These lectures have been given in a wide variety of undergraduate and graduate courses, including several outside of their assigned disciplines. In fall 2024 these librarians launched a four-part workshop series for graduate students in STEM. One of the four workshops addressed AI-powered discovery tools for literature reviews. Across these lectures numerous tools have been featured including Undermind, Research Rabbit, Inciteful, Perplexity, SciSpace, Elicit, Consensus, Scholarcy, NotebookLM and Semantic Scholar.

ISU's research efforts in artificial intelligence are primarily originating from two major research centers. The AI Institute for Resilient Agriculture [49] center aims to utilize digital twins to model plants and agronomy. This center is seeded by funds from the National Science Foundation and the United States Department of Agriculture - National Institute of Food and Agriculture. The vision for the center is to build AI digital twins to understand crop production, to deploy these tools to enhance farm yields and to adopt and democratize sustained AI usage across agriculture's value chain. Fundamental to this approach is an emphasis on education and workforce deployment, broadening participation and collaboration & knowledge transfer. The team consists of faculty in engineering and agronomy at ISU and also has collaborators from the statewide Z Soybean Association and faculty from peer institutions nationally with expertise in analytics, data science, robotics, corn promotion, agribusiness and plant breeding.

Similarly, the ISU Translational Research Center (TRaC) [50] leadership team is composed of engineering faculty and the work focuses on AI applications in materials, design & manufacturing; biology, health & quality of life; autonomy; food/energy/water nexus; ethics; and fintech. Besides being composed of faculty, the center employs full-time data scientists and research scientists. There is also an education and outreach coordinator on the center's staff. This

center also has established a student Research Experiences for Undergraduates program to inspire the next generation of student researchers. The center works with various industries, following a consortium model, to provide resources to solve relevant problems in agriculture, manufacturing and related fields. The group hosts a monthly AI research seminar series and also provides tutorials through AI workshops for the campus community and has also developed industry-specific tutorials for workforce development or to provide professional development for industrial executives. Representatives from TRaC have participated in the Summit for AI Leadership Conference (SAIL), are members of the NIST US AI Safety Institute Consortium (AISIC), have been represented in the Academic Alliance for AI Policy (AAAIP) and been invited to the US Congress CHIPS and Science Act study of AI research capacity. Internally to the university, there has been engagement with the earlier-referenced Applied AI Minor, participated in the institutional AI taskforce, designed two new AI courses and played a role in the development of an AI makerspace in the Student Innovation Center.

Beyond these works, ISU is also engaged in developing expertise in ethical and humanist artificial intelligence through a collaboration between English and philosophy and religion and in trustworthy artificial intelligence out of the Department of Computer Science.

Most interestingly, there is an AI Subcommittee on Operational Efficiencies at ISU. This group is reviewing opportunities to leverage AI towards administrative automation (scheduling, payroll and others), resource optimization (energy management, delivery routes, and others), academic support and customer service to provide personalized experiences for students and employees.

One of the cornerstone research groups involved with AI at MSU is the Predictive Analytics and Technology Integration (PATENT) Laboratory [51]. Formed from a private endowment, the lab works across disciplinary boundaries on problems in data management, integration, and analytics as well as predictive modeling and simulation. Using lab-developed tools in artificial intelligence and machine learning, the lab addresses challenges facing manufacturing, health agriculture and social sciences. One example project is outlined below:

Engineering and computer science faculty at MSU developed a collaboration that leveraged AI and LLM principles to develop a chatbot to serve the College of Engineering community, including students, staff, faculty, administration, alumni and, following the land grant mission, serve as a mechanism for community engagement [52, 53]. This chatbot was primarily focused on supporting undergraduate student recruiting. The bot also allowed for a dialogue between itself and students unsure of their intended major. Furthermore, internal records at MSU that show that half of students in the engineering college change majors at least one time during their career at the university (with about half of those changing to a different major), it supports students who are considering changing to a different major. This aids in improving overall student retention and graduation by connecting students to academic advising and student support services cosponsored by the Division of Academic Affairs and the Division of Student

Affairs. Their work explained the processes behind the development of a new LLM algorithm and outlined a few examples for the College of Engineering.

The Department of Computer Science and Engineering at MSU started a student organization called the Artificial Intelligence Club [54]. This community promotes AI in research and learning, hosts workshops and events to teach fundamentals and applications to interested students. Guest speakers come from industry, from MSU and from other universities. The group fosters a culture of collaboration and sharing ideas for supporting new initiatives to ethically enhance the value of AI work at the university.

Faculty at MSU also began a new academic journal on AI [55] focused on short, focused manuscripts in topics ranging from machine learning, robotics, natural language processing and more. Since formation last year, the journal has had two volumes with 12 published letters that, according to submission instructions, do not exceed two pages.

Discussion

Artificial Intelligence (AI) is reshaping higher education and impelling institutions to adopt strategies that align with their missions of teaching, research, and service. We have demonstrated that three land-grant universities — Iowa State University, Kansas State University and Mississippi State University — are actively integrating AI into their policies, curricula, operations and services. There are numerous similarities in their approach to this integration; however, they differ in how they structure their AI initiatives and the breadth and extent of their efforts.

ISU has implemented a centralized AI governance structure, which should support alignment with workforce development initiatives as well as adherence to policies and regulations. In addition, this approach helps coordinate AI efforts across the institution and facilitates collaboration with external partners. In contrast, KSU has adopted a more decentralized model that encourages faculty experimentation with AI tools. MSU has prioritized academic integrity and ethical AI use while gradually exploring AI’s role in education.

Interest and demand for AI literacy are burgeoning across disciplines. As a result, institutions are striving to determine how best to introduce students to AI concepts. At KSU, faculty members are incorporating AI into a wide variety of fields, including business, social sciences, and the arts. There is an emphasis on interdisciplinary engagement. ISU has taken a more structured approach by establishing an AI literacy requirement intended to ensure that all students develop a foundational understanding of AI. MSU has taken a more selective approach to AI literacy by focusing on specific programs where AI’s impact has been more conspicuous.

Each of these three universities is wrestling with the difficulty of leveraging AI to enhance their operations while simultaneously promoting academic integrity. KSU and ISU each give faculty significant discretion to decide how students can and cannot use AI in their courses. This approach protects faculty morale but creates a confusing patchwork of policies for students to negotiate. By requiring students to obtain instructor approval for AI-generated content, MSU emphasizes the importance of intellectual effort. This approach may, however, dissuade students from learning to use AI effectively.

Despite the fact that each institution is heavily focused on STEM research, there are interesting differences in how AI is impacting discovery across disciplines. KSU has incentivized interdisciplinarity, leading to research projects in business, ethics and the humanities as well as STEM fields. ISU's research efforts strongly align with industry needs, particularly in agriculture, manufacturing and automation. There is a focus on preparing students to use AI in the workforce. MSU has emphasized AI's implications for education, ethics and student advising, reinforcing its focus on responsible AI use.

At each institution, some faculty embrace AI's potential to enhance learning and research, while others demonstrate skepticism or opposition. At KSU, faculty development initiatives have been introduced to help instructors integrate AI into their work. This supports both research and teaching applications. ISU has sought to standardize AI-related policies and resources to provide institutional guidance. Achieving broad faculty engagement is an ongoing effort. Meanwhile, MSU's more restrictive approach reflects concerns about plagiarism and misinformation. This has likely influenced faculty perceptions about AI tools and inclinations to experiment with potential use cases. Each university has developed or modified curricula across the institution to address AI, including certificates at KSU, a masters' degree and a minor at ISU and a bachelors' degree at MSU.

Each institution is also wrestling with how to approach AI governance. KSU has not yet taken many actions to promote the creation of AI-related policies. Instead, they have been encouraging experimentation and faculty-driven innovation. ISU, in contrast, has launched several committees specifically charged with creating policy. MSU has prioritized ethical considerations and security in its AI policies, which helps mitigate risks but may also constrain the broader adoption of AI tools in teaching and research.

Our examination of how these three institutions are implementing AI suggests numerous avenues for research. One involves exploring how AI impacts student learning outcomes over time, particularly in engineering and technical disciplines where AI-powered tools are becoming increasingly prevalent. We also recommend that researchers investigate faculty perceptions of AI before and after AI training programs to assess the effectiveness of AI literacy initiatives. Another important avenue for research is the role of AI in academic research itself. This could

cover applications in literature reviews, data analysis and experimental design. Finally, as institutions continue to refine their AI policies, longitudinal studies could provide valuable insights into the relationships among AI, pedagogy and institutional governance in higher education.

Conclusions and Future Direction

It is clear that each institution has prioritized AI but has taken different approaches towards fostering a culture that utilizes generative AI to solve current and future problems facing society. AI has enormous transformational potential for higher education including the ability to revolutionize research, teaching and learning. As with any new modality, ethical considerations will always be present with the use of AI and must be addressed on a continuous basis by institutions. However, it is our belief that the adoption of new and emerging AI tools and methodologies will ultimately provide for a wider degree of access for students of all ages. Moving forward, our respective land-grant institutions will engage in campus-wide dialogues about the roles of generative artificial intelligence as they apply towards satisfying our institutional missions towards educating tomorrow's students, performing impactful research and helping citizens of our respective states address real-world problems. We eagerly look forward to updating the engineering education community on our progress, stumbling blocks and accomplishments over the next decade. The future is bright for AI related research and education at our land grant universities.

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