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Navigating Artificial Intelligence in Postsecondary Education:

Building Capacity for the Road Ahead

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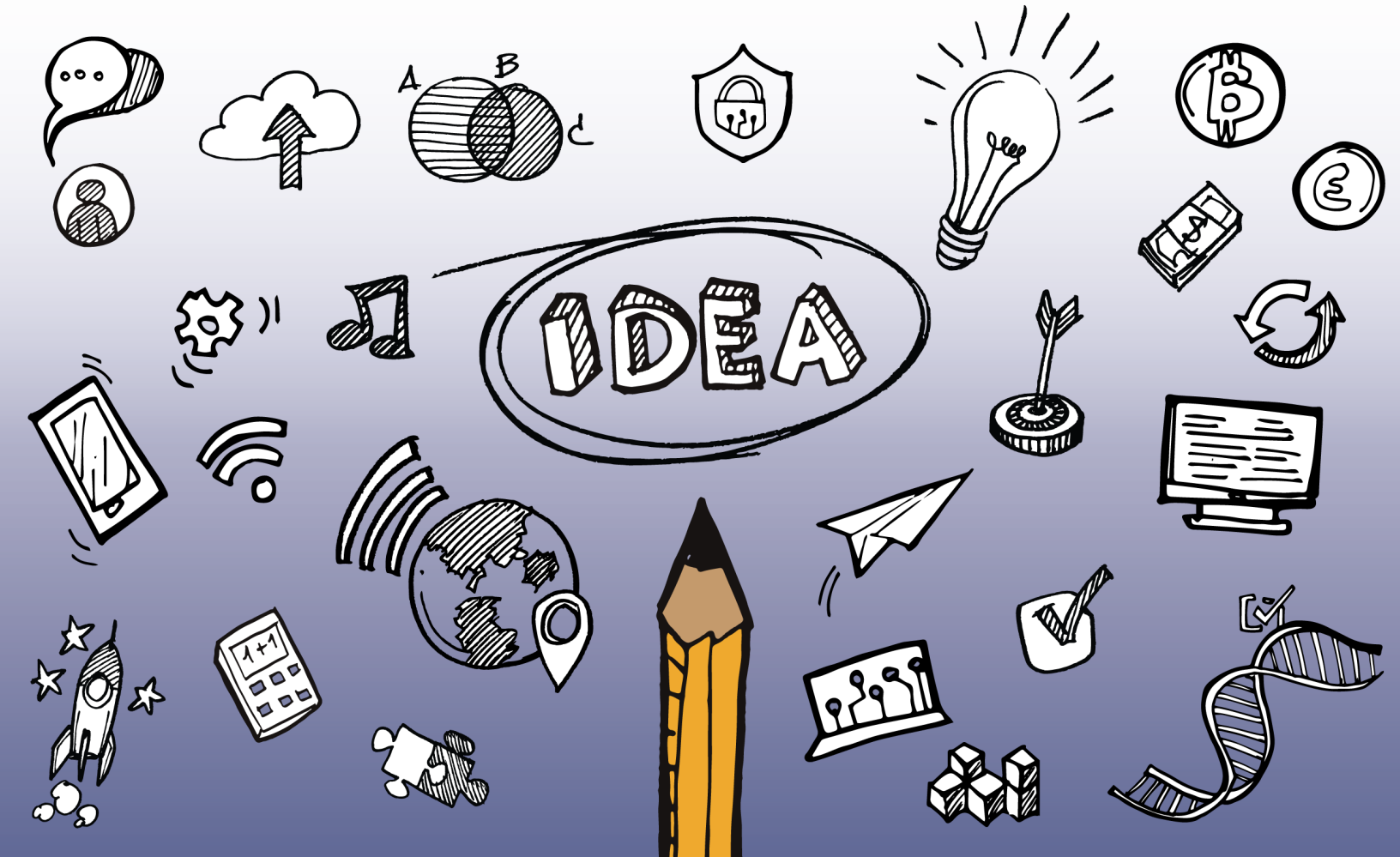

Navigating Artificial Intelligence in Postsecondary Education: Building Capacity for the Road Ahead.

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Project Team

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Executive Summary

Artificial intelligence (AI) is transforming many institutional functions at the postsecondary education level, including admissions, enrollment, academic advising, and learning environments. This brief, *Navigating Artificial Intelligence in Postsecondary Education: Building Capacity for the Road Ahead*, aims to support institutional leaders who are engaged in a cross-cutting team (such as an AI task force) that is overseeing the implementation of AI across multiple areas of their institution.

This brief assumes readers have some familiarity with AI's benefits and risks in the context of postsecondary education. We address topics that are relevant to a wide variety of institution types and provide content that is accessible to education leaders who may not have deep experience with or specific academic training in the field of AI. Because we recognize that institutions have diverse financial capabilities, the recommendations also consider both high-resource and low-resource settings to provide scalable solutions for varying budgets.

These core insights are based on the set of recommendations that are outlined in the May 2023 report, *Artificial Intelligence and the Future of Teaching and Learning*. The guidance also aligns with President Biden's Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence, focusing on enhancing student learning and institutional effectiveness while ensuring equity, fairness, and the non-discriminatory use of AI.

The U.S. Department of Education (Department) received and considered input from numerous stakeholders across the education landscape in developing its recommendations. By focusing on responsible and ethical AI practices, the brief aims to help institutions prepare learners, administrators, and faculty for changes that will come from AI-driven innovations and leverage AI to improve access and academic success, especially for underserved communities.

Key Recommendations

- **Recommendation 1: Establish transparent policies for how AI is used to support operational activities in postsecondary education settings.** AI policies can cover core areas such as managing admissions, enrollment, and resourcing decisions and help ensure fairness, accountability, and trust by allowing stakeholders to understand how data are used to support decision-making and how decisions are made.
- **Recommendation 2: Create or expand infrastructure to support the innovative application of AI in instruction, student advising and support, and assessment.** Infrastructure should support and encourage AI use that aligns with a shared vision for education and enhances educational quality and student success. Infrastructure should include support for experimental projects and professional development for AI integration by faculty and staff.

- **Recommendation 3: Rigorously test and evaluate AI-driven tools, supports, and services.** Conduct rigorous research and evaluation studies on AI-driven platforms prior to deployment. Use continuous improvement methods to ensure their effectiveness, safety, and alignment with educational goals and student needs.
- **Recommendation 4: Seek collaborative partners for designing and iteratively testing AI models across educational applications.** Forge partnerships with industry, nonprofit organizations, and other postsecondary institutions on AI design and testing, including AI use for enhancing learning experiences, improving institutional processes, and supporting diverse student needs.
- **Recommendation 5: Review, refine, and supplement program offerings in light of the growing impact of AI on future jobs and career opportunities.** Institutions may regularly assess current programs and potentially create new programs to equip both students and workers with the skills necessary for a job market increasingly influenced by AI.

Introduction

AI advancements are likely to have a profound impact on all aspects of society and every sector of the economy in the coming years, with changes already well underway. In this context, postsecondary institutions have a dual role: (1) to strategically leverage AI to help catalyze greater access and success into postsecondary education for all students, especially those from historically underserved groups; and (2) to prepare postsecondary students for the evolving career landscape shaped by AI-driven innovation. This brief, building on the Department's earlier publication, *Artificial Intelligence and the Future of Teaching and Learning: Insights and Recommendations*, provides guidance for education leaders on implementing AI applications in postsecondary settings. The Department guidance provided here is aligned with the principles and areas of emphasis outlined in the Raise the Bar: College Excellence and Equity and the Raise the Bar: Unlocking Career Success initiatives.

The insights here are intended to support institutional leaders who are engaged in a cross-cutting team (such as an AI task force) that is overseeing the implementation of AI across multiple areas of their institution. We address topics that are relevant to a wide variety of institution types and provide content that is accessible to education leaders who may not have deep experience with or specific academic training in the field of AI. We hope the following analysis and recommendations will help institutions prioritize and collaborate, including with other institutions, as they develop policies concerning the latest wave of AI tools and build enduring capacity that will allow institutions to adapt to rapid and significant technological change in the years to come.

The brief is divided into two major sections. The first provides concrete recommendations, guiding questions for leadership and faculty, and resources to help postsecondary education institutions enhance learning outcomes, improve institutional operations, and prepare students for a future that is increasingly defined by fast-paced technological change. These recommendations are inclusive and adaptive, accommodate varying levels of interest and expertise, and are designed for both high-resource and low-resource institutions to scale solutions. That said, we also recognize that some institutions may face constraints in implementing some of these recommendations. Agencies across the Federal Government, including the Department, have invested in responsible AI initiatives, and the Department encourages other organizations across the ecosystem with resources and expertise related to AI to actively collaborate with historically underserved institutions to identify ways of closing the relevant divides between institutions.

The second section is an addendum presenting evidence-based insights on AI integration. This non-exhaustive literature review examines AI's potential impact on functions such as learning environments, career readiness, admissions, enrollment, student advising, student support, digital infrastructure, and faculty development. These insights informed the final recommendations of the brief, and we hope the addendum will provide institution leaders with information for making evidence-based decisions in implementing those same recommendations.

The brief presents a broad vision of AI technologies and capabilities, based on the recommendations and a literature review, offering evidence-based insights to help institutional

leaders address policy issues and leverage AI in ways that support holistic student development and success. Across both sections of the brief, the Department stresses several key themes:

- The use of AI can support adaptivity and responsiveness to students' various needs, as long as the use of AI tools aligns with a shared vision for the education institution and leverages evidence-based principles.
- Outputs and recommendations from AI tools should be appropriately balanced with human oversight to support insightful and informed decision-making that aligns with educational goals and ethical standards.
- AI platforms should augment, not replace, faculty and administrative expertise in leading operations, providing instruction, and scaffolding student supports.
- To seize the benefits of AI, institutions should test and evaluate AI platforms and build faculty, staff, and student capacity to support their safe, responsible, and non-discriminatory use.

With these themes in mind, this brief explores broad applications of AI in higher education as described in published literature and key stakeholder engagements. The studies included here prioritize peer-reviewed articles and white paper reports of recent AI work, especially those that implemented experimental research designs. Throughout the document, the Department has included insights from roundtable discussions with faculty, staff, researchers, administrators, and representatives of labor unions from an array of institutions as well as from the AI in Postsecondary Education Working Session convened at the White House by the Department in June 2024. The roundtable discussions and the AI Working Session included representatives from large research universities, four-year teaching universities, fully online institutions, community colleges, Historically Black Colleges and Universities, Hispanic Serving Institutions, Tribally Controlled Colleges and Universities, and career and technical education programs.

This guidance is responsive to the Executive Order on the Safe, Secure, and Trustworthy Development and Use of Artificial Intelligence (Oct. 23, 2023), which states (Section 8(d)):

To help ensure the responsible development and deployment of AI in the education sector, the Secretary of Education shall, within 365 days of the date of this order, develop resources, policies, and guidance regarding AI. These resources shall address safe, responsible, and nondiscriminatory uses of AI in education, including the impact AI systems have on vulnerable and underserved communities, and shall be developed in consultation with stakeholders as appropriate.

This brief also supports efforts aligned with the Executive Order's directive regarding retooling career pathways in response to AI advances. Specifically, the Executive Order requires the Secretary of Labor to (Section 6(a)(ii)(B)):

> identify options, including potential legislative measures, to strengthen or develop additional Federal support for workers displaced by AI and, in consultation with the Secretary of Commerce and the Secretary of Education, strengthen and expand education and training opportunities that provide individuals pathways to occupations related to AI.

This brief provides non-regulatory, education-specific guidance that is aligned with federal guidelines and guardrails. Coverage of existing federal guidelines and guardrails is not comprehensive or exhaustive. It is not intended to and does not enable a postsecondary education institution to establish its compliance with regulations. Also, it is not intended to and does not introduce any new requirements. Where examples are given, including links to resources outside of the U.S. Government, they are intended to be illustrative and not to restrict the application of this guide to additional forms of AI as they become available for use in education. We are providing these external links because they contain additional information relevant to the topic(s) discussed in this document or that otherwise may be useful to the reader. We cannot attest to the accuracy of information provided on the cited third-party websites or any other linked third-party site. We are providing these links for reference only; linking to external resources does not constitute an endorsement by the Department. Education leaders can use this guide to increase their understanding of essential federal guidelines and guardrails to guide their work as they create AI applications for educational settings. Readers are also encouraged to engage with other higher education institutions and organizations to refine their approaches toward responsible AI use.

Five Recommendations for Integrating AI in Postsecondary Education

The integration of AI in postsecondary education presents a unique opportunity to enhance student supports and services, improve academic outcomes and learning, foster innovative research and development, and strengthen career preparedness for a global and digital economy. Achieving each of these potential benefits requires careful foresight and diligent planning. We offer the following recommendations to support leaders in their efforts.

Recommendation 1: Establish transparent policies for how AI is used to support operational activities in postsecondary education settings. AI policies can cover core areas such as managing admissions, enrollment, and resourcing decisions and help ensure fairness, accountability, and trust by allowing stakeholders to understand how data are used to support decision-making and how decisions are made.

While AI can improve the quality of admissions and enrollment processes,[1] as well as the quality of resourcing decisions more generally, institutions should have policies for safe and transparent use of AI to avoid perpetuating biases and exacerbating inequitable outcomes for students.

To avoid these unintended negative outcomes, institutions' AI policies should emphasize transparency, accuracy, privacy, and ethical considerations at each stage of the AI platform

[1] For example, Georgia State University leveraged an artificial intelligence as part of a systemic approach to addressing the attrition rates of students who begin the enrollment process, but do not attend during that same semester.

development or adoption processes. The National Institute of Standards and Technology (NIST) provides guidance through its *AI Risk Management Framework* (AI RMF) to help all types of organizations to understand and manage risks associated with AI by focusing on four key components of the AI lifecycle: Govern, Map, Measure, and Manage. The framework balances AI benefits with societal protection and is designed to adapt to rapid advancements and the evolving nature of AI technologies. The AI RMF is a valuable resource, but it is not education specific, so institution leaders should also seek insights from education-focused organizations, engage peer institutions, and openly communicate their experiences to promote shared learning.

Further, the Office of Management and Budget recently released the Advancing the Responsible Acquisition of Artificial Intelligence in Government memorandum (OMB M-24-18) which provides best practices for managing AI risks, particularly when it comes to rights and safety. The memorandum emphasizes strong contractual terms to protect data, ensure safe AI use, and manage its impact on public decision-making. We recommend similar considerations for institution leaders to ensure responsible AI use in education, safeguarding students' rights and privacy.

A detailed analysis of each potential aspect of a robust AI policy is beyond the scope of this brief. However, given the central role of establishing transparency through stakeholder engagement in both establishing and evaluating any AI policy, we offer two helpful examples related to emerging technological capabilities, "stealth assessment" and "continuous monitoring." Both of these examples demonstrate how a lack of transparency can erode trust among stakeholders and undermine the institution's commitment to fairness and inclusivity.

1) In its original meaning, "stealth" was a synonym for "unobtrusive" and was intended to provide authentic and supportive feedback to students while maintaining uninterrupted high student engagement in learning.[2] However, "stealth" can also imply surveillance—that students may be measured invisibly, without their knowledge, and with no direct and obvious benefit to their learning. With regard to the original meaning, students and faculty want to reduce the amount of time taken away from learning for testing and thus may appreciate unobtrusive assessment that can be embedded in learning activities, especially when it's clear how the outputs help faculty and students immediately and directly. Yet, with regard to the second meaning, faculty and students may be rightly concerned if sensitive learning data is shared beyond the classroom without their knowledge, and that could have unforeseeable consequences for the students' performance, well-being, and future opportunities. As with all data collection, clear disclosure of use and affirmative consent is of primary importance. Additionally, clearly communicating the purposes and limits of unobtrusive data collection—as well as involving teachers and students in meaningful data use—can make the difference in trust.
2) In response to campus safety concerns, some institutions have turned to AI-enabled continuous monitoring services. These services tend to leverage algorithms that have been trained to identify certain indicators of suspicious activity and can be deployed to analyze

[2] Shute, V. J. (2011). Stealth assessment in computer-based games to support learning. In S. Tobias & J. D. Fletcher (Eds.), *Computer games and instruction* (pp. 503-524). Information Age Publishers.

real time video feeds and provide "early warnings" connected to a potential security concern. However, in cases where there is not robust input from the campus community on whether or not to roll out the system, it can result in a reputational harm to the institution. These systems often require the collection of sensitive biometric data (face, gait, voice, location). Collecting these forms of data can result in significant harm if, for example, it led to cases where individuals were misidentified leading to an unwarranted interaction with law enforcement.[3,4] Furthermore, because of the multiple concerns related to safety, privacy, and civil liberties, the White House stated in the Blueprint for an AI Bill of Rights: "Continuous surveillance and monitoring should not be used in education, work, housing, or in other contexts where the use of such surveillance technologies is likely to limit rights, opportunities, or access. Whenever possible, you should have access to reporting that confirms your data decisions have been respected and provides an assessment of the potential impact of surveillance technologies on your rights, opportunities, or access." (p. 6) Thus any proposal to use AI in support of campus safety should also include an open and transparent process to assess these concerns.

Both of these examples demonstrate the need for promoting transparency through comprehensive stakeholder engagement to inform what AI systems are utilized, what data they collect, and how the data influence decision-making.

Key Questions:

- How could the Blueprint for an AI Bill of Rights or NIST AI RMF help your institution develop and adopt trustworthy AI systems?
- How can your institution work to promote transparency in its procurement and adoption of AI tools and technologies?
- How can institutions evolve their disclosure and affirmative consent practices around the use of AI to reflect the values of the campus community and uphold civil rights and civil liberties?
- How can your institution review and document the characteristics of trustworthy AI systems in its AI-driven products and services?
- How can your institution take ownership of its use of AI, ensuring that administrators, staff, and students throughout the organization understand the data being used and the tasks being supported?

Resources:

- The Blueprint for an AI Bill of Rights outlines five principles to guide the design, use, and deployment of automated systems, including AI.
- The EDSAFE AI Alliance has developed a comprehensive framework and guidelines for the use of generative AI across various stakeholder groups in the education sector. It is designed

[3] Weinstein, M. (2020). School surveillance: The students' rights implications of artificial intelligence as K-12 school security. *North Carolina Law Review, 98*(2), 438.

[4] Hassanin, N. (2023, August 23). *Law professor explores racial bias implications in facial recognition technology.* University of Calgary News.

to support AI policy labs and other stakeholders in understanding and addressing the opportunities, challenges, and ethical considerations associated with AI deployment in educational contexts.

- The CARE Principles for Indigenous Data Governance support Indigenous communities' self-determination, emphasizing data sovereignty and informed governance, developed through input from diverse experts and stakeholders.
- The Center for Innovation, Design, and Digital Learning published *Inclusive Intelligence: The Impact of AI on Education for All Learners*. The report examines AI's role in education, highlighting its potential while addressing challenges for students with disabilities and diverse learning needs.
- Complete College America's Attainment with AI playbook provides practical ideas for higher education institutions and systems to employ generative AI for student success, completion, and equity.

Recommendation 2: Create or expand infrastructure to support the innovative application of AI in instruction, student advising and support, and assessment. Infrastructure should support and encourage AI use that aligns with a shared vision for education and enhances educational quality and student success. Infrastructure should include support for experimental projects and professional development for AI integration by faculty and staff.

Supporting the safe and fair use of AI in postsecondary education requires both digital infrastructure and human infrastructure. The EDUCAUSE Higher Education AI Readiness Assessment helps institutions determine their preparedness for strategic AI initiatives across both types of infrastructure.[5] With respect to digital infrastructure, robust and secure digital networks are essential to protect sensitive data and maintain privacy. Indeed, comprehensive cybersecurity measures are also crucial to protect against potential threats and disruptions.

To build or customize AI systems, institutions need access to robust computing resources, including cloud computing services,[6] to effectively run AI applications. These resources are essential for processing large datasets, conducting real-time analytics, and integrating AI into academic and administrative functions. Cloud computing can also provide additional processing power, scalability, and storage capabilities that surpass or augment on-site hardware, ensuring that AI models can be built and customized efficiently. It is important to note that training, updating, and leveraging AI models can be energy resource intensive. Institutions should monitor this activity and align their efforts with their broader goals of reducing environmental impacts.

The Department notes there are wide disparities between institutions in terms of access to the infrastructure needed to safely and effectively leverage AI. Consortia and resource centers that

[5] EDUCAUSE. (2024, April). *Higher Education Generative AI Readiness Assessment.*

[6] Cloud computing provides on-demand access to remote servers over the internet, allowing institutions to make use of scalable processing power, vast storage, and advanced networking, making it possible to run AI applications, process large datasets, and perform real-time analytics without the limitations of traditional on-site hardware.

bring together a broad array of diverse institutions (such the National Artificial Intelligence Research Resource described below) are being organized to help to reduce such disparities, but more effort and attention is needed in this area to avoid exacerbating existing digital divides.

Just as the Department is concerned about divides between institutions, institutions should also take care to promote practices that enhance digital equity[7] among students and staff. In many cases this will include ensuring that students and staff have equitable access to internet connectivity, digital devices, and AI platforms that can help enhance their learning and career opportunities.

However, digital infrastructure alone won't lead to equitable AI innovation. Planning to support human infrastructure is also needed to equip students, faculty, and staff with essential AI literacy skills for safe and effective use of the technology.[8] AI literacy involves the knowledge and skills to understand, use, and evaluate AI systems critically, promoting safety and ethics in communities. This includes recognizing and addressing how AI technologies can facilitate discrimination and harassment, such as through the nonconsensual distribution of images that have been altered or generated by AI technologies. Key activities for AI literacy programs include understanding, evaluating, and integrating AI into learning environments, operations, and student support systems. Education leaders are in the best position to decide how to cover these areas based on their specific contexts. Students will undoubtedly enter postsecondary education with vastly different levels of AI literacy. Non-traditional students may experience particular challenges in developing AI literacy skills since they may have delayed enrollment in postsecondary education after high school, making it harder to adapt to rapidly evolving technological concepts. To support students equitably and fairly, AI literacy approaches should be flexible enough to benefit learners entering postsecondary school at different stages of their life and educational journey.

Institutions should provide support for general and discipline-specific professional development for faculty and staff that addresses the use of AI tools in teaching and learning. This can be accomplished through an appropriate office (such as a center for academic innovation, libraries division, or academic technology office) that conducts a needs assessment and develops a comprehensive faculty development plan for AI in teaching and learning. Promising AI tools and applications will vary across different academic disciplines, suggesting that at least part of the professional development be designed for groups of faculty within the same discipline or program.[9]

Faculty should be given the time and opportunity to collaborate with their peers to learn how to implement broad-use AI models in their teaching and research. Faculty, staff, and students should also be provided the opportunity to give input into how AI is used in teaching and learning. These opportunities should provide faculty with time to grapple with substantive questions like how to define appropriate AI use for a given learning objective, how to integrate AI-driven assistive

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[7] Section 60302(10) of the Infrastructure Investment and Jobs Act defines "digital equity" as "the condition in which individuals and communities have the information technology capacity that is needed for full participation in the society and economy of the United States."

[8] Office of Education Technology. (2024, April). *AI Literacy 101: An Introduction to Artificial Intelligence*. U.S. Department of Education.

[9] Lee, L-K., Cheung, S. K. S., & Kwok, L-F. (2020). Learning analytics: Current trends and innovative practices. *Journal of Computers in Education, 7*(1), 1–6.

technologies that support students with disabilities or English language learners, how to evaluate the results of an AI detection tool, and how to build strong relationships with students that can foster trust and integrity as everyone adapts to new norms.

One example of a successful culture of innovation can be seen in Carnegie Mellon University's Generative AI Teaching as Research (GAITAR) programs, which are designed to build instructor capacity for adapting, innovating, and conducting scholarship on the use of generative AI in teaching and learning. Participants of the GAITAR program attend workshops and consultations to develop testable research questions, design teaching innovations and interventions, identify data sources, and plan classroom research studies to rigorously evaluate the impacts of their ideas. The program is open to all faculty members, postdocs, and graduate students who want to reflect on and improve their teaching.

Key Questions:

- How can your institution incentivize cross-department collaboration across academic departments, disciplines, and faculty to participate in the design, implementation, and evaluation of AI tools that support teaching and learning?
- How can research on social and behavioral sciences enhance the rigorous evaluation of AI systems?

Resources:

- The National AI Research Resource Pilot offers training and computational resources to help educators integrate AI into their curricula, helping them stay current with AI developments. This enables students to acquire practical AI skills for future careers and ensures that institutions can effectively teach and utilize AI technology.
- The EDUCAUSE Higher Education Generative AI Readiness Assessment guides institutions in understanding their preparedness for strategic AI initiatives.
- In developing AI-related infrastructure and platforms, institutions may find it valuable to consult the Department of Labor's Artificial Intelligence and Worker Well-being: Principles for Developers and Employers.
- The Report from the National Institute for Learning Outcomes Assessment, *Equity and Assessment: Moving Towards Culturally Responsive Assessment*, provides guidance on culturally responsive assessments, equitable evaluation methods, and data disaggregation to support targeted interventions for diverse students.
- The University of Maine's Learn with AI Toolkit and Auburn University's self-paced Teaching With AI course provide support for faculty and students to integrate AI into their teaching and learning processes.
- The University of Michigan offers free GenAI services to students, faculty and staff. These include U-M GPT for accessing popular AI models, U-M Maizey for enriching experiences with custom datasets, and U-M GPT Toolkit for advanced AI environment control.

Recommendation 3: Rigorously test and evaluate AI-driven tools, supports, and services. Conduct rigorous research and evaluation studies on AI-driven platforms prior to deployment. Use continuous improvement methods to ensure their effectiveness, safety, and alignment with educational goals and student needs.

Testing and evaluating AI is not monolithic, though its various elements are sometimes conflated. This conflation can cause an institution to overlook important aspects of AI's impact that may have long-term institutional consequences. The Department has included two sub-recommendations in this section to distinguish between two separate – yet related – elements. This distinction helps to ensure testing and evaluation activities meet overall objectives. Recommendation 3a focuses on making sure that AI systems can operate in alignment with ethical and privacy standards, while 3b focuses on using research to build high-quality evidence on the effectiveness (e.g., what works, for whom, and under what conditions) of AI systems in improving education outcomes.

Recommendation 3a. Institutions should test AI products and services to ensure they are safe, equitable, mitigate the risk of algorithmic discrimination, and protect student privacy. These procedures should include rigorous evaluation methods, stakeholder feedback, and ongoing monitoring to ensure AI solutions align with ethical standards, civil rights and privacy obligations, and educational goals.

Implementing robust procedures for testing AI products and services is crucial to mitigate the risk of algorithmic discrimination and ensure that AI-enabled solutions are equitable and protect student privacy. It is recommended that scholars conduct research in partnership with historically underserved groups to promote collaboration among AI technologists and educators to develop culturally responsive AI systems.[10]

In order to understand the potential impacts of AI systems on historically underserved groups, it is important to consider the requirements of federal civil rights laws,[11] including issues of algorithmic discrimination and accessibility as specific equity-related concerns of AI integration. Existing laws (including civil rights laws) are paramount and apply to situations where any variation of artificial intelligence leads to any discrimination across the continuum of a student's learning experience and in all of the school's operations. Federal civil rights laws protect students against discrimination based on race, color, national origin, sex, disability, and age.[12]

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[10] Mouta, A., Pinto-Llorente, A. M., & Torrecilla-Sánchez, E. M. (2023). Uncovering blind spots in education ethics: Insights from a systematic literature review on artificial intelligence in education. *International Journal of Artificial Intelligence in Education, 33*, 290–324.

[11] Postsecondary institutions and their leaders must comply with civil rights laws and are prohibited from discriminating on prohibited bases against students, applicants, and employees. Institutions may find this overview of the Department of Justice's Civil Rights Division's work on AI and civil rights of interest. Importantly, this guide does not attempt to discuss all of the civil rights provisions that could potentially apply to AI use in education settings.

[12] E.g., Title VI of the Civil Rights Act of 1964, 42 U.S.C. § 2000d, 34 C.F.R. part 100; Title IX of the Education Amendments of 1972, 20 U.S.C. § 1681, et seq., 34 C.F.R. part 106; Section 504 of the Rehabilitation Act of 1973., 29 U.S.C. § 794, 34 C.F.R. part 104; Americans with Disabilities Act of 1990, 42 U.S.C. § 12131, et seq., 28 C.F.R. parts 35 and 36; Age Discrimination Act of 1975, 42 U.S.C. § 6101, et seq., 34 C.F.R. part 110.

The White House Office of Science and Technology's Blueprint for an AI Bill of Rights defines "algorithmic discrimination" and outlines an appropriate institutional response:

> Algorithmic discrimination occurs when automated systems contribute to unjustified different treatment or impacts disfavoring people based on their race, color, ethnicity, sex (including pregnancy, childbirth, and related medical conditions, gender identity, intersex status, and sexual orientation), religion, age, national origin, disability, veteran status, genetic information, or any other classification protected by law. Depending on the specific circumstances, such algorithmic discrimination may violate legal protections. Designers, developers, and deployers of automated systems should take proactive and continuous measures to protect individuals and communities from algorithmic discrimination and to use and design systems in an equitable way.

Institutions should test and evaluate AI products or services used in educational contexts, both proactively and on an ongoing basis, to mitigate the risk of algorithmic discrimination. Research has documented algorithmic discrimination in specific educational applications of AI (or prior uses of machine learning), including when race/ethnicity and socioeconomic status are used to predict a particular outcome (e.g., the likelihood of a student failing a course).[13, 14] The use of AI systems to deliver services or inform decisions could discriminate against students on a prohibited basis, or erode their privacy, and these are issues that can be addressed by developers as early as the initial design phase through the testing and implementation phases. In the spirit of *mitigating the risks associated with AI in order to seize its benefits*, institutions will need to attend to emergent risk such as:

- As guidance counselors use AI-assisted tools to recommend college and career pathways, who will detect and counter unfairness in the recommendations due to biases in historical data sets that were used to develop the AI model, and which could harm vulnerable populations?
- As educators use AI to simplify their work by writing emails or other correspondence about their students' work, who is responsible for safeguards against disclosing a student's private information to unintended recipients, including the developer of the AI model?
- As administrators and school leaders procure early warning systems to identify students who may be "at risk," who has sufficient knowledge and time to evaluate whether the AI developer adhered to scientific, legal, and privacy standards necessary to safeguard students' civil rights?
- As educators deploy anti-plagiarism detectors to identify a student's inappropriate use of edtech, who has responsibility for recognizing weaknesses and biases in AI-based detectors that could lead to disciplining students unfairly or unequally? Who ensures that underserved and vulnerable populations are not unfairly targeted?

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[13] Gándara, D., Anahideh, H., Ison, M. P., & Picchiarini, L. (2024). Inside the black box: Detecting and mitigating algorithmic bias across racialized groups in college student-success prediction. *AERA Open, 10.*

[14] Baker, R. S., & Hawn, A. (2022). Algorithmic bias in education. *International Journal of Artificial Intelligence in Education,* 1-41

To protect against discriminatory outcomes, developers and institutions will need to work together to involve students and faculty from historically underserved groups in every phase of the design and implementation life cycle. This involves designing evaluations of AI tools to be both comprehensive by covering a broad, random sample, and detailed by analyzing the specific impacts on different subgroups to ensure equitable outcomes.

Because educational inequity can occur unintentionally, institutions should focus testing and evaluation on the overall impact of AI. This applies to the use of AI-enabled solutions in curriculum, as well as any technology or solution that can be used for monitoring behavior, classroom management, or discipline.

Note that the potential for algorithmic discrimination is not limited to applications that make big decisions, such as guiding student course or career selection, but can also occur in a series of smaller or seemingly inconsequential decisions (for example, in the pacing or content of technology-based lessons) that, taken together, may create an inequitable learning environment for students. At the same time, it is worth noting that AI systems can also be a valuable asset in the effort to promote equity. For example, AI systems can be designed to challenge and mitigate biases through certain tools that help determine how high-level concepts, such as "race," "gender," or "income," influence the decisions made by AI models. By quantifying the impact of these concepts on a model's output, these tools aid in understanding, detecting, and potentially mitigating biases within AI systems.[15]

Any AI-driven student support tools that are developed or adopted should comply with the Web Content Accessibility Guidelines (WCAG) international standard and any emerging guidelines specific to AI and the web.[16] This ensures accessibility to web content for users, including those with disabilities, by providing equal access to information and functionality. Compliance with these standards also addresses the unique challenges and opportunities of AI technologies. Additionally, these tools should undergo regular evaluations to ensure they continue to meet evolving accessibility standards and best practices.

In addition to equity concerns, the integration of AI in postsecondary education also raises critical issues related to safety, data privacy, and ethical use. Training and improving AI systems can require extensive data collection, storage, and use, including sensitive student information, which necessitate robust privacy safeguards to prevent misuse and ensure compliance with federal laws such as the Family Educational Rights and Privacy Act (FERPA).[17]

One major area of concern is the potential for AI systems to inadvertently infringe on student privacy through the monitoring and analysis of academic data. These systems can track student

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[15] Christian, B. (2021). The alignment problem: How can machines learn human values? Atlantic Books.

[16] Regulations issued under Title II of the Americans with Disabilities Act, 28 C.F.R. §§ 35.200 – 35.205, establish requirements for the accessibility of State and local public entities' (including public postsecondary educational institutions) web content. For information about the requirements and the effective dates of these requirements, see ADA.gov.

[17] Crompton, H., & Burke, D. (2023). Artificial intelligence in higher education: The state of the field. *International Journal of Educational Technology in Higher Education, 20*(22).

performance, engagement, and even behavioral patterns, which, if not properly managed, could lead to unauthorized access or misuse of personal information. To mitigate these risks, institutions should implement stringent data governance frameworks and ensure transparency in how student data is collected, stored, and used.[18]

The Family Educational Rights and Privacy Act (FERPA) (20 U.S.C. § 1232g; 34 CFR part 99) is a federal law that protects the privacy of students' education records. The term "education records" is defined under FERPA, with certain exclusions, as those records that are directly related to a student and which are maintained by an educational agency or institution, such as a college or university, or by a party acting for the agency or institution, to which funds have been made available under any program administered by the Secretary of Education. FERPA affords eligible students certain rights with regard to their education records. Under FERPA, an "eligible student" is any student who is 18 years of age or is attending a postsecondary institution at any age. These rights include the right to inspect and review education records, the right to seek to have the education records amended, the right to have some control over the disclosure of personally identifiable information from the education records, and the right to file a written complaint with the Student Privacy Policy Office in the U.S. Department of Education regarding an alleged violation of FERPA. Under FERPA, an educational institution is prohibited from disclosing personally identifiable information from education records, without consent, unless the disclosure meets an exception to FERPA's general consent requirement. One such exception permits an educational institution to disclose, without consent, personally identifiable information from student education records to contractors, consultants, volunteers, or other third parties to whom the institution has outsourced institutional services or functions, provided that the outside party: constitutes a school official with a legitimate educational interest under the criteria listed in the institution's annual notification of FERPA rights; performs an institutional service or function for which the institution would otherwise use employees; is under the direct control of the institution with respect to the use and maintenance of education records; and is subject to the requirements in FERPA which provides that the personally identifiable information from education records may be used only for the purposes for which the disclosure was made, and which governs the re-disclosure of personally identifiable information from education records. In addition, an educational institution must use reasonable methods, such as physical or technological access controls, to ensure that school officials obtain access to only the education records in which they have legitimate educational interests. For more information on FERPA, visit the Department's Student Privacy website: https://studentprivacy.ed.gov/. The Guidance for Eligible Students is at: https://studentprivacy.ed.gov/resources/eligible-student-guide-family-educational-rights-and-privacy-act-ferpa.

[18] Bond, M., Khosravi, H., De Laat, M., Bergdahl, N., Negrea, V., Oxley, E., …Siemens, G. (2024). A meta systematic review of artificial intelligence in higher education: A call for increased ethics, collaboration, and rigour. *International Journal of Educational Technology in Higher Education, 21*(4).

Key Questions:

- What strategies can your institutions use to deploy AI platforms that operate with appropriate levels of ethical human supervision?
- How can your institution incorporate comprehensive stakeholder feedback into the testing and monitoring of AI solutions to ensure these technologies align with ethical standards and educational goals? How will this process ensure that there is robust crosstalk between administrators, developers, and stakeholders most at risk of algorithmic discrimination?
- What testing, ongoing monitoring practices and technical, administrative, or physical safeguards are essential for protecting student privacy and avoiding algorithmic discrimination while using AI-driven products and services? How can institutions ensure continuous compliance with these practices? Similarly, what monitoring practices are needed to identify and assess AI's impact on equity and fairness, and mitigate the risk of algorithmic discrimination when it is present?

Resources:

- The Artificial Intelligence and Algorithmic Fairness initiative aims to ensure that AI and other emerging tools used in employment decisions comply with federal civil rights laws. It will closely examine how technology changes employment decisions and guide applicants, employees, employers, and technology vendors to use these technologies fairly, in line with federal equal employment opportunity laws.
- NIST is working on a standard for identifying bias in AI, with three main ways in which bias occurs (systemic, statistical/computational, and human), which intersect with different foci for mitigating bias (in datasets and models, during development of applications, and as applications of AI are used in the field). NIST has also released a generative AI risk profile that is a companion resource to the AI RMF.
- A Global Information Society Watch 2019 report details examples of opportunities and challenges of AI in different use contexts, including education. The report has a particular focus on social justice and human rights, drawing on examples across the globe in various sectors.

Recommendation 3b. Institutions should evaluate AI systems through iterative cycles of testing, feedback, and improvement. These efforts should build high-quality evidence on the abilities of AI platforms to support the institutions' student services by providing continuous, personalized, and holistic support to address the needs of diverse learners.

Studies of AI-driven tools should determine what works, for whom, and under what conditions. Comprehensive and transparent reporting of these studies, in accordance with applicable law, builds trust and guides evidence-based decision-making in educational policy and practice. This applies to areas such as advising systems, academic supports, mental health resources, and career guidance, to ensure that AI enhances the overall educational experience. In designing and developing these studies, institution leaders may find the standards set forth by the Institute of Education Sciences for evaluating research studies to be a helpful resource.

Deciding on the most appropriate AI model(s) to use for a particular purpose is not always straightforward. Some institutions have developed processing for making these determinations by using a combination of benchmarking studies and rigorous research across different AI models. These studies help institutions identify which models or configuration of models are most effective and under what circumstances. Where possible, and in accordance with applicable law, the results of these studies should be shared with other institutions. For example, the Institute of Education Sciences works to help institution leaders generate, find, and use high-quality evidence through the What Works Clearinghouse and the Regional Educational Laboratories. Furthermore, given the ongoing advancements in AI, it is crucial to continually evaluate whether existing models still perform as expected or if new models or systems need to be developed or integrated.

> Benchmarking studies are ways of measuring the performance of models against a defined set of metrics. These studies are often useful in comparing the technical performance of different models. The result of these studies can help institution leaders to understand broadly the models' capabilities (e.g. error rates on translation, scores on standardized tests, or solving opened physics problems). These studies themselves do not tell you how well the model will perform when deployed in complex or changing environments, and they cannot be used to determine causal impacts of an AI model on student learning. For that, institutions must use rigorous research designs like those described above from the What Works Clearinghouse.

Benchmarking studies and rigorous research of new and existing AI platforms in postsecondary education should be used to evaluate the effectiveness, scalability, and impact of the platforms on student learning outcomes and administrative efficiencies. AI outputs should be monitored through both automated quality assurance systems–for example, a screening tool that reviews user inputs and AI outputs, especially when operating at scale–and experienced human advisors, who can intervene when complex or sensitive issues arise that require human judgment.

Key Questions:

- How can your institutions ensure that human advisors adequately review interactions between students and the AI system to provide feedback and updates to the AI platform? Similarly, how can your institution receive feedback from students on their experience with AI platforms?
- In what ways can your institutions better include diverse voices in AI development and adoption to create an inclusive and equitable AI ecosystem in education?
- How can your institutions create streamlined pathways to facilitate comprehensive evaluation of AI models (e.g., appropriate access to high-quality data or clear reporting procedures of findings)?

Resources:

- Two examples of collaborative infrastructure are the Institute of Education Sciences' SEERNet program and the National Science Foundation's SafeInsights initiative, both of which leverage digital learning system data for education while prioritizing student privacy.

- The Center for Equitable AI and Machine Learning Systems (CEAMLS) at Morgan State University advances research, standards, and technology for fair and unbiased AI. CEAMLS educates students and the public on the impact of AI, serving as an interdisciplinary hub for equitable tech applications.

Recommendation 4: Seek collaborative partners for designing and iteratively testing AI models across educational applications. Forge partnerships with industry, nonprofit organizations, and other postsecondary institutions on AI design and testing, including AI use for enhancing learning experiences, improving institutional processes, and supporting diverse student needs.

Collaborative partnerships between educators, researchers, and technology developers offer benefits to an educational institution (or a consortia of education institutions) in several ways. Institutions benefit from educators' expertise in pedagogy, researchers' expertise in measurement and evaluation, and from technology companies' technical expertise and resources, allowing for the creation of more tailored educational solutions that address specific institutional needs.[19, 20] For example, institutions that work with technology providers may benefit from cost-effectiveness and economies of scale, lessening the financial load of developing technology in-house.[21]

Institutions should structure partnerships so that educators and learners are included throughout the AI development and deployment process and seek to include not only decision makers but also those who will be most affected by design choices in a product or service. Through ongoing collaboration, educational institutions, research entities, and technology partners will be better equipped to enhance learning environments and student support systems and improve operational efficiencies.

Productive partnerships can be fostered through collaborative networks that bring together diverse stakeholders. Here we highlight a few examples of different types of partnerships and their various goals:

- The Institute of Education Sciences' SEERNet program is a network of platform developers, researchers, and education stakeholders who collaborate to conduct research that leverages the large-scale reach of digital learning platforms (DLPs) while also informing the design of learning experiences within DLPs. The collaborative approach facilitates the alignment of DLP improvements with education needs and research findings. Networks like SEERNet enable stakeholders to share best practices, conduct research, and implement advanced technologies to enhance education.
- Arizona State University (ASU) is leveraging partnerships to explore and implement a variety of AI-driven approaches. The ASU AI Innovation Challenge encourages members of the ASU community to propose and develop impactful AI applications across various

[19] Selwyn, N. (2021). *Education and Technology: Key Issues and Debates* (3rd ed). Bloomsbury Publishing.
[20] U. S. Department of Education, Office of Educational Technology. (2017). *Reimagining the Role of Technology in Education: 2017 National Education Technology Plan Update*.
[21] Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research? *Educational Researcher, 41*(1), 16-25.

academic and administrative areas. Faculty across disciplines are exploring the potential of generative AI through ASU's Generative AI Community of Practice.

- The City University of New York (CUNY) and its partners developed a predictive AI tool that increased graduation rates from 54 percent to 86 percent in two years. The AI model used data from students facing various challenges, such as being first-generation or working while studying, and it analyzed 75 risk indicators (e.g., variation in grades, attendance patterns, GPA semester average, years of enrollment) to help advisers support students at risk of dropping out. The project emphasized co-creating solutions, refining models through small-scale trials, and using AI to augment, not replace, personal support.[22]
- The National Center for Student Success at Georgia State University is also working to support a consortium of institutions in leveraging research-based AI chat bots to help improve student success.

Key Questions:

- How can your institution identify and prioritize potential internal and external collaborative partners to effectively design and test AI models that enhance learning experiences and improve institutional processes?
- What best practices should your institution follow to ensure that partnerships in AI design and testing enable work that addresses diverse student needs and promotes equitable outcomes across various educational applications?
- How can your institution effectively advocate for and partner with other institutions and the technology industry to prioritize the development of AI models that are transparent, accessible, and aligned with educational needs?

Resources:

- The Department recently released *Designing for Education with Artificial Intelligence: An Essential Guide for Developers*. This guide is intended to support working organizations developing AI platforms for use in education settings. As a central principle, it encourages and provides recommendations on collaboration between education institutions and developers, emphasizing the importance of designing educational solutions in partnership with educators to build a foundation of trust.
- The Artificial Intelligence Incubator Network Initiative, managed by the American Association of Community Colleges (AACC), aims to establish AI incubators nationwide with industry funding. This 18-month project supports community colleges by developing AI content and providing resources such as monthly discussions, economic development opportunities, student engagement strategies, and AI incubation best practices.
- Lever for Change, an affiliate of the John D. and Catherine T. MacArthur Foundation, provides resources and guidance for both initiating new collaborations and enhancing existing ones. These resources include advice on strategic mergers, key questions for starting

[22] Lucariello, K. (2023, October 12). *AI predictive model partnership dramatically raises CUNY graduation rate.* Campus Technology.

collaborations, and tools for creating inclusive planning processes. The aim is to support effective and equitable partnerships in various sectors.

Recommendation 5: Review, refine, and supplement program offerings in light of the growing impact of AI on future jobs and career opportunities. Institutions may regularly assess current programs and potentially create new programs to equip both students and workers with the skills necessary for a job market increasingly influenced by AI.

The rapid advancement of AI technologies requires a proactive approach in postsecondary education to ensure that academic programs remain relevant and adequately prepare students for the evolving job market. The potential impact of AI on current and future job roles indicates there is a need for a re-appraisal of the relevance and adequacy of postsecondary educational offerings. To support their students, institutions should prepare to reshape instruction to focus on those competencies that are essential for navigating the changing world of work, such as critical thinking, creativity, communication, and collaboration.

Academic leaders should evaluate the competencies required for careers within their disciplines, considering the capabilities of generative AI tools and related advances. This appraisal should also address the potentially positive and negative impacts of AI advances on particular roles and tasks and the arrival of new AI-intensive roles or tasks.

Institutions should also begin equipping students from all disciplines with the AI literacy skills (i.e., the knowledge and skills to understand, use, and evaluate AI systems critically, promoting safety and ethics), and AI specific courses they are likely to need for their careers. This includes placing an appropriate amount of emphasis on the diverse impacts that automation is having on various fields and highlighting those fields that are projected to see both high rates of task-specific automation and an overall increase in demand for workers.[23] For example, the University of Florida's initiative, AI Across the Curriculum, incorporates AI literacy for all students and specialized AI curricula in specific departments.

Another example is Barnard College developing an AI literacy framework that serves as a conceptual guide for AI education in postsecondary education.[24] This framework categorizes AI literacy into four levels: understanding AI, using and applying AI, analyzing and evaluating AI, and creating AI. These categories are reflected in Barnard's curriculum offerings, such as the "GenAI 101" workshops, which provide hands-on training with AI tools, and "Collaborative Prompt Engineering Labs," which focus on refining skills in generating and improving AI outputs. Additionally, Barnard offers instructional workshops on AI ethics, covering critical topics like ethical implications, copyright issues, and environmental impacts.

The importance of integrating AI literacy into educational programs is perhaps most apparent when one examines AI's transformative impact on scientific research. AI accelerates data analysis, facilitating faster processing of vast datasets and significantly reducing the time from hypothesis to

[23] McKinsey Global Institute. (2024, May 21). *A new future of work: The race to deploy AI and raise skills in Europe and beyond.* McKinsey & Company.
[24] Coffey, L. (2024, June 11). *Inside Barnard's pyramid approach to AI literacy*. Inside Higher Ed.

discovery. It also enhances predictive modeling, leading to more accurate simulations in areas such as climate science and medicine. Furthermore, AI fosters interdisciplinary innovation by automating routine tasks, allowing scientists to focus on creative problem-solving, thus driving the next wave of scientific breakthroughs.

One compelling example of AI's impact is in pharmaceutical research, where AI is transforming the drug discovery process.[25] Traditionally, drug discovery has been costly and time-consuming, with high failure rates. However, AI-driven platforms can now identify novel drug targets for complex diseases and design entirely new molecules that would have been extremely difficult for human chemists to identify. AI can test and optimize hundreds of potential drug candidates in a fraction of the time required by traditional methods, increasing the efficiency and success rates of drug development. Once a potential drug target is identified, AI generates a large array of candidate molecules and tests them in simulated environments to assess their efficacy and safety. This iterative process allows for the refinement of molecules, informed by data from previous studies, patient records, and molecular simulations. The result is a streamlined drug discovery process that explores multiple hypotheses simultaneously, often leading to the discovery of novel and structurally unique molecules, thus expanding the boundaries of chemical and biological research.

The integration of AI across contexts exemplifies the evolving landscape that colleges and universities will need to monitor, so they can prepare their graduates to enter a workforce with adaptive skills and proficiency in leveraging tools for automation. As AI continues to evolve, its role in education and research will be critical in preparing the next generation of professionals to navigate and shape the future of their respective fields.

Key Questions:

- How can your institutions keep abreast of emerging demands for new AI-enabled professions?
- What steps can your institutions take to make sure students from historically underserved groups are aware of, and have opportunities to enter, new programs centered around AI-enabled competencies?
- How can AI be integrated into all disciplines to enhance the relevance of these programs in an AI-driven job market?
- How can your institutions use AI to scale effective lifelong learning and training models, and what role can AI play in advancing apprenticeships and skill development for displaced workers?
- What metrics and evaluation methods can be used to assess the effectiveness of AI-integrated programs and their alignment with job market requirements?

Resources:

- Ohio State offers an online Artificial Intelligence in Digital Health certificate that explores AI's role in the health care industry.

[25] Arnold, C. (2023). Inside the nascent industry of AI-designed drugs. *Nature Medicine, 29*(8), 1292–1295.

- Emory University unveils interdisciplinary AI minor open to all undergraduates.
- Purdue University's College of Liberal Arts has introduced an interdisciplinary program that blends philosophy with computer science, equipping students with the programming and data analysis skills necessary to navigate the ethical challenges posed by AI.
- Miami Dade College opened an AI Center that provides resources to students, faculty, staff, and the community across all campuses to teach, learn, and collaborate on AI topics.
- The MIT Center for Information Systems Research collaborated with Johnson & Johnson to develop MySkills, a machine learning-based talent development platform. MySkills assesses employees' current skill levels, identifies skill gaps, and offers development and career opportunities.
- The Vets in AI program integrates veterans into the AI field by providing education, employment, and entrepreneurship opportunities. It offers an extensive AI curriculum, bootcamps, workshops, and mentorship, and fosters collaboration between veterans, tech companies, and policymakers.
- Jobs for the Future published *The AI Ready Workforce*, which evaluates the potential impact of AI on the tasks and skills associated with jobs across various sectors of the economy.
- The Council of Economic Advisors in The White House offers an economic framework for understanding the impacts of AI on the workforce in Chapter 7 of the Economic Report to the President.
- The National Academies published *Artificial Intelligence and the Future of Work*, which explores the rapid advancements in AI and their profound impact on the workforce, productivity, and various industries. It addresses AI's opportunities in enhancing work and innovation, alongside challenges like bias and societal integration.

Conclusion

The integration of AI in postsecondary education offers significant opportunities to enhance learning outcomes, streamline institutional operations, and prepare students for a future that is increasingly defined by fast-paced technological change. This brief has outlined the transformative potential of AI in various aspects of colleges and universities, including admissions, enrollment, academic advising, and personalized learning environments. By leveraging AI, institutions can improve efficiency, support data-driven decision-making, and create more personalized and engaging student experiences.

However, the deployment of AI in postsecondary education should be approached with careful consideration of ethical implications, particularly concerning equity, fairness, privacy, and the non-discriminatory use of technology. Institutions have a dual responsibility: to utilize AI to drive institutional improvements that promote broad and equitable access to education and to equip students with the skills necessary to thrive in an AI-influenced world. This entails developing robust data governance policies, investing in AI literacy and professional development, conducting research on AI's impact on student learning, and ensuring that AI applications are safe, transparent, accountable, and aligned with educational goals.

The recommendations provided in this brief offer a strategic framework for postsecondary education leaders to navigate the complexities of AI integration. Key areas of focus include establishing transparent policies, building infrastructure to support AI innovation, conducting rigorous research on AI tools, fostering collaborative partnerships, ensuring equitable and ethical AI use, and regularly updating academic programs to align with the evolving job market.

As AI continues to evolve, it is imperative for postsecondary institutions to remain adaptable and proactive in their approach. By doing so, they can harness the potential of AI to enhance educational quality, support student success, and contribute to a more inclusive and equitable society. The Department remains committed to supporting institutions in this journey, providing guidance and resources for the safe, responsible, and non-discriminatory use of AI in postsecondary institutions.

Addendum on Evidence-Based Insights About AI Integration

This addendum has two major subsections: AI in Enhancing Learning and Instruction, and AI Support for Institutional Operations. This section conveys evidence-based insights about the integration of AI in institutional academics and operations to support institutional leaders' decision-making on policies and supports. This non-exhaustive literature review is intended to assist researchers and institution leaders to better understand the research base associated with the use of AI systems by postsecondary education institutions. The studies summarized in this addendum provided the foundation for crafting the brief's recommendations; however, it is also important to note that the Department considered input from a variety of sources in crafting the recommendations.

AI in Enhancing Learning and Instruction

AI technologies are likely to profoundly impact teaching, learning, and assessment. Regardless of whether an institution has a formal strategy for incorporating AI into academics, generative AI tools are already widely used.[26] By understanding both AI's capabilities and its shortcomings, academic leaders and administrators can position their institutions to use AI in teaching and learning in ways that complement human interactions and support students' academic success. In this brief, we have focused our attention on topics and studies that address several priority aspects of postsecondary education. For a more comprehensive review of AI and its impact on instruction broadly, readers may find it valuable to consult the Department's *Artificial Intelligence and Future of Teaching and Learning Report*.

AI-Enhanced Learning Environments

A substantial research base supports the use of AI-driven adaptive learning environments for enhancing learning outcomes. Adaptive systems are built on learner models that consider what the learner knows and does, addressing cognitive, affective, and behavioral aspects of learning.[27] These systems consider variables such as learner knowledge and proficiency (cognitive), interest in the topic (affective), and study habits and help-seeking behaviors (behavioral). A review of studies of the efficacy of AI-enabled adaptive systems found significant improvements in students' cognitive learning outcomes compared to non-adaptive interventions, particularly in computer science and mathematics courses. The effect sizes varied, with longer interventions showing greater impacts.[28]

[26] Tyton Partners. (2023, October). GenAI in Higher Education: Fall 2023 Update Time for Class Study.

[27] Vandewaetere M., Desmet P., & Clarebout G. (2011). The contribution of learner characteristics in the development of computer-based adaptive learning environments. Computers in Human Behavior, 27(1), 118–130.

[28] Wang, X., Huang, R., Sommer, M., Pei, B., Shidfar, P., Rehman, M. S., …Martin, F. (2024). The efficacy of artificial intelligence-enabled adaptive learning systems from 2010 to 2022 on learner outcomes: A meta-analysis. *Journal of Educational Computing Research, 0*(0).

The personalization in AI-driven adaptive learning environments is key to their success. AI-based systems provide content to students at appropriate levels of difficulty based on the learners' past results. This is particularly salient for providing students with feedback on their learning. Research shows that low-stakes quizzes and frequent practice tests with prompt feedback improve learning outcomes by reinforcing material and identifying knowledge gaps. Timely feedback helps correct misunderstandings quickly, enhancing retention and comprehension.[29, 30] Formative feedback is also enhanced, as these systems can track student progress over time, identifying trends and patterns in performance to offer continuous feedback that evolves with the learner's development.[31]

Generative pretrained transformer (GPT) models are proving capable of providing just-in-time individualized help for cognitive aspects of learning. A randomized study compared learning gains from a GPT to those from human tutor-authored help across four math subjects. Results showed that learners receiving GPT help had significantly higher gains than learners in the control condition who received no help at all. Learners receiving human tutor-authored help also showed gains, but the gains were not statistically distinct from those for the control or GPT groups. GPT-generated solutions were produced 20 times faster than human-authored solutions, including time for error checking the GPT output. High "hallucination"[32] or "confabulation" rates in early versions of the GPT help were reduced to nearly 0 percent in Algebra and 13 percent in Statistics by using self-consistency, an error mitigation technique. Near-zero hallucination rates suggest the potential for dynamically generating personalized help in Algebra without manual error checking.[33]

Educators can also benefit from integrating AI into learning environments. AI can automate routine tasks, allowing instructors to focus their time and effort on areas where they can add the most value. For instance, in adaptive learning environments AI systems can provide students with immediate feedback, which enables educators to offer support where it is most needed.

AI-enabled tools such as essay scoring systems and Automatic Short Answer Grading (ASAG) are becoming more common. These systems use AI to assist in examining the content of essays to score the quality of students' writing, comprehension of topics, and ability to express ideas clearly. ASAGs are designed to calculate how closely a student's response aligns with the expected or model answer to grade concise written replies typically found in short-answer exams. A review of ASAGs describes the variability in the accuracy of these systems, with some achieving strong correlations with human scores and others indicating significant room for improvement. The review highlights

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[29] Haughney, K., Wakeman, S., & Hart, L. (2020). Quality of feedback in higher education: A review of literature. Education Sciences, 10(3), 60.

[30] Quality Matters. (2023). *Specific Review Standards from the Quality Matters Higher Education Rubric*. (7th ed.)

[31] Luckin, R. (2017). Towards artificial intelligence-based assessment systems. *Nature Human Behaviour, 1*(0028).

[32] This term has been used in popular discussion about generative AI. The official term that is adopted by the National Institute for Standards and Technology is "confabulation."

[33] Pardos, Z. A., & Bhandari, S. (2024). ChatGPT-generated help produces learning gains equivalent to human tutor-authored help on mathematics skills. *PLoS ONE, 19*(5), e0304013.

that ensemble methods have shown significant promise in enhancing the robustness and effectiveness of ASAG systems.[34]

> The ensemble approach enhances prediction accuracy by combining multiple models. For example, in predicting student dropouts in online courses, it uses different prediction methods to aggregate results for greater precision. A random forest classifier, an ensemble method, consists of numerous decision trees analyzing different student data aspects, such as grades, participation, and login frequency. Each tree makes its own prediction, with some predicting retention and others predicting dropout. The random forest then takes the majority vote among the trees, providing a more reliable and accurate prediction than any single tree could have. This method helps online platforms better identify students needing extra support to stay in the course.

Findings from the National Assessment of Educational Progress (NAEP) Math and Reading Automated Scoring Challenges indicate promising outcomes for automated scoring systems. The goal of the NAEP challenge was to assess the potential of automated scoring techniques in evaluating open-ended responses to reading assessment items, with a focus on determining the current capabilities, accuracy metrics, validity evidence, and cost efficiencies of an automated approach. Key findings highlight that automated scoring can effectively replicate human scores assigned to most NAEP reading items, with large language models proving to be the most accurate approach in scoring assessments. It was found that the results in the math challenge did not exhibit bias, in contrast to the reading challenge where some items showed significant bias for the English learner (EL) subpopulation.

AI can automate time-consuming aspects of teaching and provide feedback to instructors on their instructional practices, helping them improve. A recent study examined the effectiveness of an AI tool designed to support instructors in a large-scale, online programming course, which facilitated weekly meetings between instructors and students conducted on an online video platform. The tool provides instructors with weekly automated feedback on incorporating student contributions, such as acknowledging, revoicing, and integrating student ideas into instruction. The results showed that instructors who received the feedback showed improved integration of student ideas, enhancing instructional quality and student engagement. However, the study authors noted decreased accuracy in the speech transcriptions for non-native English speakers and that the effectiveness of the feedback varied with instructors' characteristics, such as their gender and teaching experience in the course.[35] These issues could raise potential concerns under federal civil rights laws as described under Recommendation 3a.

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[34] Gao, R., Merzdorf, H. E., Anwar, S., & Hipwell, M. C. (2024). Automatic assessment of text-based responses in post-secondary education: A systematic review. *Computers and Education: Artificial Intelligence, 6*, 100206.

[35] Demszky, D., Liu, J., Hill, H. C., Jurafsky, D., & Piech, C. (2023). Can automated feedback improve teachers' uptake of student ideas? Evidence from a randomized controlled trial in a large-scale online course. *Educational Evaluation and Policy Analysis, 0(0).*

Note that AI technologies can also be embedded in or support parallel technologies. For example, the synergies between AI and extended reality (XR) technologies, including virtual reality (VR) and augmented reality (AR), are likely to grow in the near future. Recent studies on the use of XR technologies in educational contexts reveal significant enhancements in skills development and learner engagement, particularly in hospitality, medicine, and science studies.[36] For instance, a study involving engineering students demonstrated that those who used an AR intervention had significantly higher posttest operational skills (e.g., connecting equipment, generating signals, adjusting controls) compared to the control group, underscoring the positive impact of AR on skills acquisition.[37]

There is also growing interest in designing XR platforms to support students with disabilities. A meta-analysis evaluating the effectiveness of VR- and AR-based interventions for individuals diagnosed with autism spectrum disorder found significant positive outcomes. Studies on VR training and rehabilitation found large effect sizes in improving individuals' daily living skills, with moderate effect sizes noted in enhancing cognitive skills, social-emotional regulation skills, and communication skills. Studies on AR-based training also showed promising effects, although these applications require further research.[38]

Several studies of an immersive VR classroom simulation program augmented with generative AI have found that the simulation effectively bridges the gap between theory and practice for pre-service teachers.[39, 40] Other scholars have offered a framework for developing educational content using XR technologies for adult learners, focusing on complex skills training across various professional fields. The framework combines learning theories with learners' proficiency levels to define competency-based learning objectives and activities. It incorporates XR form factors (various types of XR technologies suitable for learning and training), and learning loops, which are structured sequences of steps to facilitate effective learning processes. The framework enhances the effectiveness of XR training programs by providing a roadmap for designing XR applications that improve adult learning, making the training process more efficient and effective.[41]

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[36] Bermejo, B., et al. (2023). AR/VR teaching-learning experiences in higher education institutions (HEI): A systematic literature review. *Informatics, 10*(2), 45

[37] Singh, G., & Ahmad, F. (2024). An interactive augmented reality framework to enhance the user experience and operational skills in electronics laboratories. *Smart Learning Environments, 11*(5).

[38] Karami, B., Koushki, R., Arabgol, F., Rahmani, M., & Vahabie, A.-H. (2021). Effectiveness of virtual/augmented reality–based therapeutic interventions on individuals with autism spectrum disorder: A comprehensive meta-analysis. *Frontiers in Psychiatry, 12,* 665326.

[39] Dieker, L., Hughes, C., & Hynes, M. (2023). The past, the present, and the future of the evolution of mixed reality in teacher education. *Education Sciences, 13*(11), 1070.

[40] Lee at al. (2023). *Generative agent for teacher training: Designing educational problem-solving simulations with large language model-based agents for pre-service teachers*. NeurIPS'23 Workshop on Generative AI for Education (GAIED).

[41] Stanney, K. M., Skinner, A., & Hughes, C. (2023). Exercisable learning-theory and evidence-based andragogy for training effectiveness using XR (ELEVATE-XR): Elevating the ROI of immersive technologies. *International Journal of Human–Computer Interaction, 39*(11), 2177–2198.

NIST provides guidance on addressing and managing risks associated with bias in the design, development, and use of AI technologies. The guidance assists organizations in designing, developing, deploying, or evaluating AI in various contexts. This comprehensive approach is intended to mitigate the inherent biases in technology processes that can lead to harmful impacts, fostering trustworthiness and public trust in AI.

Incorporate AI Education Across Disciplines

AI will have significant impacts on the workplace in nearly every field by automating tasks, increasing productivity, and reshaping job roles. According to the World Economic Forum's *Future of Jobs 2023* report, 34 percent of job tasks are automated by AI today, and this figure is expected to rise to 42 percent by 2027. A Cornell University study evaluating the potential impact of Large Language Model-enhanced software on the U.S. workforce estimates that approximately 80 percent of the U.S. workforce could have at least 10 percent of their job tasks influenced by LLM-enhanced software, with about 19 percent of workers potentially experiencing AI's impact on at least 50 percent of their job tasks. The researchers conclude that AI impacts are not confined to high-productivity industries, and access to LLMs could enable about 15 percent of all tasks performed by U.S. workers to be completed significantly faster while maintaining quality.[42] These impacts extend well beyond the careers that have historically been impacted by automation and include fields such as the arts and humanities, the law, STEM careers, and community services.

Postsecondary institutions have a crucial role in preparing students for a dynamic workforce and aiding in the reskilling of workers displaced by AI advancements. Previous research confirms the importance of aligning college majors with labor market opportunities to enhance earnings and reduce unemployment rates.[43, 44] AI, as a topic of study, is becoming priority content, not simply for computer scientists and engineers but for all students. Enhancing the alignment between education environments and the evolving workforce landscape can be particularly beneficial for Black, Hispanic, and foreign-born workers, potentially helping them bridge earnings and employment gaps. Researchers stress the role of educational and career counseling services to guide individuals toward high-demand majors, and advocate for programs that encourage students from underrepresented groups to pursue these fields. Employers benefit, in turn, by hiring individuals whose education aligns with job requirements, promoting diversity and inclusivity.[45]

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[42] Eloundou, T., Manning, S., Mishkin, P., & Rock, D. (2023). *GPTs are GPTs: An early look at the labor market impact potential of large language models*. arXiv.

[43] Chau, H., Bana, S. H., Bouvier, B., & Frank, M. R. (2023). Connecting higher education to workplace activities and earnings. PLoS ONE, 18(3), e0282323.

[44] Sublett, C., & Tovar, J. (2021). Community college career and technical education and labor market projections: A national study of alignment. *Community College Review, 49*(2), 177-201.

[45] Holzman, B., Han, J., Cortes, K. E., Lewis, B., & Chukhray, I. (2024). *Closing the gap for racial minorities and immigrants through school-to-work linkages and occupational match*. (EdWorkingPaper: 24-947). Annenberg Institute at Brown University.

AI Supports for Institutional Operations

In addition to its impacts on what students need to learn and on how teaching and learning unfold, AI technologies are unleashing a host of opportunities to improve the way colleges and other postsecondary educational institutions operate. Areas of active innovation and experimentation with AI include recruiting, admissions, enrollment, academic advising, and support services of all kinds.

AI-Supported Recruiting, Admissions, Retention, and Enrollment Services

AI is supporting recruiting, admissions, retention, and enrollment services in postsecondary education, offering algorithmic tools to streamline processes and enhance decision-making. By incorporating AI technologies, institutions can improve efficiency, personalize student experiences, and make data-informed decisions to support diverse and inclusive student bodies.

Among an institution's strategic operations, forecasting enrollment and attrition is pivotal because it deeply influences institutional planning, resource allocation, and student support services. Although most colleges and universities have been using algorithms to predict enrollment and attrition for some time, recent developments in machine learning are paving the way for institutions to employ computational methods that are more closely aligned to their strategic priorities. By continually refining their prediction models, colleges and universities can adapt to changing educational landscapes and help students navigate these critical transitions.

Researchers have proposed various machine learning models aimed at predicting student attrition in university environments. These models have consistently identified students at risk of dropping out with higher levels of accuracy than other statistical methods.[46, 47] These studies also indicate that incorporating both quantitative and qualitative variables enhances the predictive accuracy of a model. For example, data on study habits as well as GPA and other factors enable these models to discern patterns that might not be apparent through traditional analyses.[48] Other research found that machine learning methods outperformed traditional statistics and even a commercial service in predicting student enrollment, providing highly predictive results with minimal use of demographic data. The careful minimization of the use of demographic is a very important step in mitigating the risk of algorithmic discrimination. Results from multiple years of enrollment predictions proved to be highly accurate and consistently reliable.[49]

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[46] Barramuño, M., Meza-Narváez, C., & Gaálvez-García, G. (2022). Prediction of student attrition risk using machine learning. *Journal of Applied Research in Higher Education, 14*(3), 974–986.

[47] Kemper, L., Vorhoff, G., & Wigger, B. U. (2020). Predicting student dropout: A machine learning approach. *European Journal of Higher Education, 10*(1), 28–47.

[48] Ahmad, Z., & Shahzadi, E. (2018). Prediction of students' academic performance using artificial neural network. *Bulletin of Education and Research, 40*(3), 157–164.

[49] Hansen, D. M. (2020). Using artificial neural networks to predict matriculation of university prospects. *Strategic Enrollment Management Quarterly, 8*(1), 21–22.

AI is being used to help distribute financial aid in a more balanced way. At one institution, researchers developed an AI-based program to optimize scholarship and financial aid distribution, balancing enrollment and revenue goals with student needs for affordability and accessibility. The algorithm iteratively adjusted the initial fund distribution based on feedback, refining the approach to meet multiple objectives. Using data from domestic first-time freshmen, including test scores, GPA, and financial need, while excluding demographic information to reduce bias, the researchers were able to identify several budget-conscious strategies. These strategies maintained educational affordability, increased access, and can be adapted to meet a variety of specific goals and student needs.[50]

Using predictive models for need-based aid carries significant risks. Financial aid is crucial for accessing postsecondary education and reducing inequality, enabling individuals from diverse financial backgrounds to pursue their educational goals.[51] Colleges using AI for financial aid allocation should proceed with caution, thoroughly documenting all data processes, examining how aid allocations affect students' graduation rates, and remaining vigilant to potential inequities in student outcomes.

AI-based systems have started to impact the freshman admissions process. Admission offices have traditionally relied on standardized test scores to categorize large applicant pools and identify subsets of candidates for further review. However, this method is subject to biases in test scores and the selection process involved in test-taking. One study investigated a machine learning-based approach that replaces the use of standardized tests in creating applicant subsets by instead considering a broader range of factors derived from student applications, thus enabling a more holistic review. An evaluation of that approach found that the prediction model, trained on previous admissions data, outperformed an SAT-based heuristic and closely mirrors the demographic composition of the last admitted class. The study authors emphasize the crucial role of human advisors in the admission process, highlighting their necessity for providing a nondiscriminatory evaluation. Predictions can help uncover a broader talent base by allowing admissions officers to target a subset of applicants for closer examination, highlighting candidates who might have otherwise been overlooked.[52]

As AI becomes increasingly integrated into learning environments, it is essential to align it with equity and inclusion values to mitigate biases and meet non-discrimination requirements. Although much has been written about AI fairness, practical guidance for practitioners remains scarce. A

[50] Phan, V., Wright, L., & Decent, B. (2022). Optimizing financial aid allocation to improve access and affordability to higher education. *Journal of Educational Data Mining, 14*(3).

[51] Dynarski, S., Page, L. C., & Scott-Clayton, J. (2022, July). College Costs, Financial Aid, and Student Decisions (Working Paper No. 30275). National Bureau of Economic Research.

[52] Lee, H., Kizilcec, R. F., & Joachims, T. (2023). Evaluating a learned admission-prediction model as a replacement for standardized tests in college admissions. In Proceedings of the 2023 ACM Conference on Learning at Scale (L@S '23) (pp. 1-10). Association for Computing Machinery.

recent study[53] directly addresses this gap by developing a step-by-step framework for implementing AI fairness techniques, focusing on a grade prediction case study at a public university. The study emphasizes the importance of incorporating multiple and overlapping bases for identification—such as the overlap of race and gender—not merely as data points but as central to institutional values of equity and inclusion. The research shows that techniques like adversarial learning[54] can effectively reduce biases, particularly in overlapping categories like race-gender and race-income. This framework offers actionable insights for practitioners to design more equitable AI systems and helps ensure compliance with relevant policies and regulations.

AI-Supported Student Advising

AI should support the emerging consensus regarding academic advising, as reflected in the Department's Attaining College Excellence and Equity Advising Summit, which emphasized the importance of cohesive advising models based on four key principles: data-driven advising tailored to individual needs, holistic support integrating various forms of guidance, professional development for advisors, and systemic integration linking advising with institutional support services and academic departments. This strategy addresses students' diverse needs and embeds advising within the broader educational framework, creating an environment conducive to student learning and success.

Postsecondary institutions are considering various ways AI can enhance student advising. These include offering personalized academic guidance, integrating career planning with academic advising, and making predictions of students' course performance. Recent studies[55] have examined AI's role in supporting robust college advising systems. AI agents, such as chatbots and recommender systems, can personalize student support, but their effectiveness varies.

> AI technologies, including chatbots, GPTs, and machine learning models, show promise for improving student success. Chatbots are particularly effective in assisting students with immediate administrative tasks, particularly in the early weeks of a semester.[55] GPTs provide better guidance on students' major selection when more details about the majors are included.[56] Additionally, machine learning models that include standardized test scores with administrative data have greatly improved predictive accuracy of identifying students at risk of course failure.[57]

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[53] Mangal, M., & Pardos, Z. A. (2024). Implementing equitable and intersectionality-aware ML in education: A practical guide. *British Journal of Educational Technology, 00*, 1–36.

[54] Adversarial learning trains machine learning models using deceptive inputs, called adversarial examples, to improve their reliability by exposing them to challenging inputs during training.

[55] Page, L. C., Meyer, K., Lee, J., & Gehlbach, H. (2023). *Conditions under which college students can be responsive to nudging.* (EdWorkingPaper No. 20-242). Annenberg Institute at Brown University.

[56] Lekan, K., & Pardos, Z. (2023). AI-augmented advising: A comparative study of ChatGPT-4 and advisor-based major recommendations. *Proceedings of Machine Learning Research, 38*, 1-20.

[57] Bertolini, R., Finch, S. J., & Nehm, R. H. (2021). Testing the impact of novel assessment sources and machine learning methods on predictive outcome modeling in undergraduate biology. *Journal of Science Education and Technology, 30*(1), 193–209.

AI-Enhanced Student Support

Postsecondary education is starting to explore the many ways in which AI can support students. These include supports for learning how to learn, implementing universal design principles that accommodate student learning differences, and mental health support.

Several studies on AI in postsecondary education highlight the potential of AI in enhancing students' self-regulated learning (SRL) and improving educational outcomes. One study of an AI framework for SRL demonstrated that AI can enhance students' self-evaluation, self-regulation behaviors, and self-efficacy, leading to higher learning gains and satisfaction. This framework helps monitor student behavior, provide feedback, and support the development of SRL skills.[58] A study exploring students' perceptions of AI applications found that students generally perceive AI as beneficial for metacognitive, cognitive, and behavioral regulation but prefer human support for motivational aspects of learning.[59] Other research found that AI-driven dashboards can improve students' academic performance and self-regulation skills and explanations for performance declines, yet a noted limitation was the lack of time management functionality.[60, 61]

AI tools can provide much-needed support for English language learners during their postsecondary education. A generative AI-based video chatbot can act as a speaking partner for language learners through immersive video calls with AI avatars.[62] Intelligent personal assistants using machine learning have been found to positively impact learners' speaking skills and learning attitudes, especially when used with instructor guidance.[63] For writing assignments, AI-based web applications can offer more structured assistance than traditional word processors by reducing learners' cognitive barriers (e.g., working memory) in writing. These tools assist with low-level tasks such as word production and translation, allowing learners to focus on higher-level writing tasks like organization and revision.[64] Automated feedback systems (AFSs) are also valuable, helping students identify areas for improvement, track progress, and gain confidence, which fosters

[58] Huang, X., Dong, L., Vignesh, C., & Kumar, P. (2022). Self-regulated learning and scientific research using artificial intelligence for higher education systems. *International Journal of Technology and Human Interaction, 18*(7), 15.

[59] Shin, I., Im, K., Yoo, M., Roll, I., Seo, K. (2023). Supporting students' self-regulated learning in online learning using artificial intelligence applications. *International Journal of Educational Technology in Higher Education, 20,* 37.

[60] Afzaal, M., Zia, A., Nouri, J., & Fors, U. (2024). Informative feedback and explainable AI-based recommendations to support students' self-regulation. *Technology, Knowledge and Learning, 29*(1), 331–354.

[61] Prasad, P., & Sane, A. (2024). A self-regulated learning framework using generative AI and its application in CS educational intervention design. In *Proceedings of the 55th ACM Technical Symposium on Computer Science Education V. 1 (SIGCSE 2024),* (pp. 1070-1075). ACM.

[62] Wan, Y., & Moorhouse, B. L. (2024). Using Call Annie as a generative artificial intelligence speaking partner for language learners. *RELC Journal, 0(*0).

[63] Yang, C. T. Y., Lai, S. L., & Chen, H. H. J. (2022). The impact of intelligent personal assistants on learners' autonomous learning of second language listening and speaking. *Interactive Learning Environments,* 1–21.

[64] Gayed, J. M., Carlon, M. K. J., Oriola, A. M., & Cross, J. S. (2022). Exploring an AI-based writing assistant's impact on English language learners. *Computers and Education: Artificial Intelligence, 3*, 100055.

learner autonomy and emotional self-regulation. AFSs are particularly effective when combined with human feedback and appropriate course structure.[65]

Research shows that AI-driven tools can support college students with disabilities, including sensorimotor disabilities. For example, speech-to-text and text-to-speech tools can assist students who have a hearing impairment or who struggle with reading comprehension.[66, 67] Another study used multimodal data and machine learning to detect and influence students' affective states to enhance engagement and learning for students with intellectual impairments. The study found that tailoring activities to individual emotional states significantly increased engagement and reduced boredom, but longer exposure is needed to determine the impact on learning outcomes.[68] A study of neurodivergent learners in higher education noted the lack of alignment between traditional learning models and the unique needs of neurodivergent students. The study highlighted the importance of offering a more flexible and self-directed learning environment and aligning teaching approaches with neurodiversity-affirming practices.[69] Applications of AI hold promise for exploring tailored learning models for supporting neurodivergent learners.

AI-driven tools also have shown promise for supporting students' mental health. A meta-analytic study of AI-driven conversational agents found that use of the tool significantly reduced symptoms of depression and distress among college students. These effects were more pronounced in agents that were multimodal (voice + text), generative AI-based, integrated with instant messaging apps, and targeting clinical, subclinical, and older populations. Students' experience of the tool was shaped by the therapeutic relationship, the quality of the content, and how often they experienced communication breakdowns. The benefits of using AI-based conversational agents are not without risks. Their use should be accompanied by professional oversight to ensure appropriate interventions and mitigate risks such as privacy violations, biases, and safety concerns.[70]

Institution leaders should carefully monitor AI platforms that are intended to support students to prevent and address biases that could lead to unfair or discriminatory outcomes. A systematic literature review examined the ethical dimensions of AI in education, highlighting gaps in studies and emphasizing the need for inclusive AI systems that address the biases that emerge from a Western and STEM-focused approach. The researchers recommended collaboration between AI

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[65] Li, L., & Kim, M. (2024). It is like a friend to me: Critical usage of automated feedback systems by self-regulating English learners in higher education. *Australasian Journal of Educational Technology, 40*(1), 1–18.

[66] Bakken, J. P., Uskov, V. L., & Varidireddy, N. (2019). Text-to-voice and voice-to-text software systems and students with disabilities: A research synthesis. In V. Uskov, et al. (Eds), S*mart Education and e-Learning 2019. stemSmart Innovation, Systems and Technologies, 144.* Springer, Singapore.

[67] Wood, S. G., Moxley, J. H., Tighe, E. L., & Wagner, R. K. (2018). Does use of text-to-speech and related read-aloud tools improve reading comprehension for students with reading disabilities? A meta-analysis. *Journal of Learning Disabilities, 51*(1), 73–84.

[68] Standen, P. J., Brown, D. J., Taheri, M., Trigo, M. J. G., Boulton, H., Burton A., …Hortal, E. (2020). An evaluation of an adaptive learning system based on multimodal affect recognition for learners with intellectual disabilities. *British Journal of Educational Technology, 51*(5), 1748–1765.

[69] Friedman, Z. L., & Nash-Luckenbach, D. (2024). Has the time come for heutagogy? Supporting neurodivergent learners in higher education. *Higher Education*, *87*(1), 1905–1920.

[70] Li, H., Zhang, R., Lee, Y., Kraut, R. E., & Mohr, D. C. (2023). Systematic review and meta-analysis of AI-based conversational agents for promoting mental health and well-being. *npj Digital Medicine, 6*(236).

researchers and educators to develop culturally responsive AI systems. The review stressed incorporating ethical AI education into curricula to enhance students' understanding of AI's functions, impacts, and ethics by integrating AI concepts across subjects and promoting societal discussions. It also emphasized maintaining student diversity and agency, suggesting that effective personalization should balance tailored content with opportunities for exploring diverse perspectives and employing independent learning methods and project-based strategies.[71]

Some institutions, especially Tribally Controlled Colleges and Universities, have begun to explore options for leveraging AI-based tools (e.g., language learning applications and digital archives) to support recording, transmitting, and revitalizing Indigenous knowledge rooted in centuries-old traditions. The unique characteristics of Indigenous data, shaped by distinct cultural, social, and historical backgrounds, require careful consideration in ownership, collection, interpretation, and use. AI systems should be designed with cultural sensitivity to respect Indigenous worldviews and avoid biases. Ethical challenges, including potential misuse and misappropriation, demand cautious and respectful approaches. Ensuring data sovereignty and protecting the privacy and intellectual property rights of Tribal communities are critical, as they advocate for the right to own, control, and govern their data. Informed consent and robust data security measures are essential to safeguard Indigenous cultural information.[72]

Increased concerns about campus safety have prompted some institutions to implement advanced AI surveillance technologies, such as facial recognition and geolocation tracking, to enhance security measures.[73] However, collecting these highly sensitive forms of data can result in significant harm if, for example, it results in cases where individuals are egregiously or systematic misidentified, leading to unnecessary interaction with law enforcement or other legal, social, or financial consequences.[74, 75] The collection and storage of Personally Identifiable Information (PII) present substantial privacy concerns, as cameras record the images and activities of individuals. Organizations, including security firms and transportation agencies, may need access to surveillance data, which can lead to misuse or illegal use of shared video records. Privacy-preserving algorithms and systems should be prioritized to avoid ethical challenges and biases.[76]

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[71] Mouta, A., Pinto-Llorente, A. M., & Torrecilla-Sánchez, E. M. (2023). Uncovering blind spots in education ethics: Insights from a systematic literature review on artificial intelligence in education. *International Journal of Artificial Intelligence in Education, 33,* 290–324.

[72] United Nations Educational, Scientific and Cultural Organization. (2023). *Open data for AI: what now?*

[73] Sasirekha, V., Malarvizhi, C., Ramadevi, R., Mohankumar, N., & Aarthi, P. (2024, March 1-3). Intelligent campus safety management using IoT and CNNs for surveillance, access, and emergency response. Paper presented at the *3rd International Conference for Innovation in Technology (INOCON)*, Karnataka, India.

[74] Weinstein, M. (2020). School surveillance: The students' rights implications of artificial intelligence as K-12 school security. *North Carolina Law Review, 98*(2), 438.

[75] Hassanin, N. (2023, August 23). *Law professor explores racial bias implications in facial recognition technology*. University of Calgary News.

[76] Ardabili, B. R., Pazho, A. D., & Noghre, G. A. (2023). Understanding policy and technical aspects of AI-enabled smart video surveillance to address public safety. *Computational Urban Science, 3,* 21.

Infrastructure to Support AI Innovation

Infrastructure in postsecondary education plays a crucial role in supporting technological innovation.[77] Strategic long-term planning and comprehensive infrastructure are essential to support sustainable AI scaling, adapt to technological advancements, and maintain data integrity and privacy.

According to the EDUCAUSE 2024 AI Landscape Study, training is the most common component of an institution's AI-related strategy, with 56 percent of institutions providing AI training for faculty, 49 percent for staff, and 39 percent for students. However, the proportion of institutions with plans for technological infrastructure is much lower. Only 15 percent of survey respondents reported creating technology infrastructure to run generative AI models on-campus or through infrastructure-as-a-service cloud computing platforms. The cautious approach toward investing in in-house AI capabilities is primarily motivated by concerns over costs, data privacy, and security.

Resilient infrastructure requires establishing institutional policies governing the transparent and ethical use of AI. Research on AI policy frameworks emphasizes the importance of accuracy, clarity on sources of error, and communication of uncertainties in algorithms and data used to support decision-making. Transparent policies enable external examination and independent review of algorithms to ensure that AI systems operate as intended, free from harmful biases or errors. These policies highlight the importance of explainability in algorithmic decisions which can be facilitated by the use of explainable AI (XAI) tools that help visualize AI processes, interpret model predictions, and explain the relevance of input data in generating outputs.[78]

Professional development (PD) for faculty will be crucial to equip educators with the skills and knowledge needed to integrate AI into their teaching practices. Research on postsecondary PD underscores the importance of balancing academic freedom with the need for continuous professional growth. Studies highlight that top-down mandates often face resistance, suggesting that involving faculty in planning and implementation increases acceptance and participation.[79] A significant challenge is the integration of professional learning within the constraints of time and space, as well as the cost of such initiatives.[80] Innovative approaches that emphasize both collaborative learning and individualized training are recommended to improve trust and knowledge-sharing among faculty and to develop a learning environment that supports

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[77] Deacon, B., Laufer, M., & Schäfer, L. O. (2022). Infusing educational technologies in the heart of the university—A systematic literature review from an organisational perspective. *British Journal of Educational Technology, 53*(6), 1932-1951.

[78] Nagy, M., & Molontay, R. (2024). Interpretable dropout prediction: Towards XAI-based personalized intervention. *International Journal of Artificial Intelligence in Education, 34*(1), 274–300.

[79] Golhasany, H., & Harvey, B. (2022). Academic freedom, the impact agenda, and pressures to publish: Understanding the driving forces in higher education. *SN Social Sciences, 2*(163).

[80] Fabriz, S., Hansen, M., Heckmann, C., Mordel, J., Mendzheritskaya, J., Stehle, S., … Horz, H. (2020). How a professional development programme for university teachers impacts their teaching-related self-efficacy, self-concept, and subjective knowledge. *Higher Education Research & Development, 40*(4), 738–752.

experimentation.[81] Knowledgeable mentors can play a crucial role in guiding faculty through these learning processes, ensuring that PD initiatives are both responsive and impactful.[82] Partnerships within institutions are equally important. A case study at Norfolk State University (NSU) demonstrates how collaboration between academic and student affairs offices can enhance student success, retention, and degree attainment, especially in under-resourced settings like HBCUs. Collaboration at NSU established a campus culture of innovation and cooperation that was supported by leadership. Efficient use of limited resources spurred innovation, allowing faculty and staff to discover and utilize hidden assets. Regular assessments provided insights into strengths and weaknesses, guiding improvements in collaborative efforts. These structural and cultural factors, along with a strong institutional mission, motivated and sustained collaborative efforts that led to positive student outcomes.[83]

Finally, system interoperability, data portability, and secure data sharing practices are key components in the successful application of AI in educational settings. For example, a learning management system (LMS) can seamlessly interact with AI tools to personalize learning experiences by accessing and analyzing student data such as grades, learning patterns, and participation levels.[84] Seamless data exchange allows students to receive customized learning experiences and provides educators with insights to improve instructional strategies. Data sharing practices should prioritize student privacy and the protection of sensitive information.

[81] Pischetola, M., Møller, J. K., & Malmborg, L. (2023). Enhancing teacher collaboration in higher education: The potential of activity-oriented design for professional development. *Education and Information Technologies, 28*(6), 7571–7600.

[82] Barry, W. (2022). The role of 'knowledgeable others' in supporting academics' professional learning: implications for academic development. *Perspectives: Policy and Practice in Higher Education, 27*(1), 16–25.

[83] Commodore, F., Gasman, M., Conrad, C., & Nguyen, T.-H. (2018). Coming together: A case study of collaboration between student affairs and faculty at Norfolk State University. *Frontiers in Education, 3.*

[84] Pesovski, I., Santos, R., Henriques, R., & Trajkovik, V. (2024). Generative AI for customizable learning experiences. *Sustainability, 16*, 3034.