

Artificial Intelligence In & For Medical Education

Oct. 31, 2024



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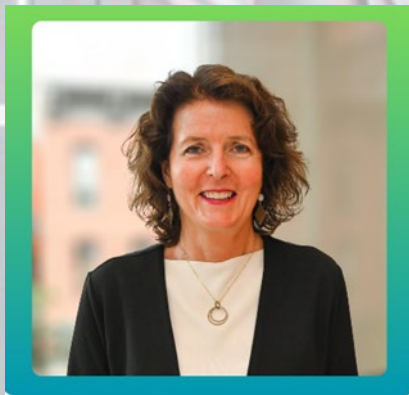
Lead



Association of
American Medical Colleges

Artificial Intelligence *IN* and *FOR* Medical Education

Alison Whelan, MD
Chief Academic Officer
AAMC



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Senior Director
Transforming Medical Education
AAMC



Kim Lomis, MD
Vice President
Medical Education Innovations
AMA



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training in AI

AI in training

“Educators and leaders need to optimize the training environment to prepare trainees for a future far different than the one their teachers have known.” – Robert Wachter, MD 2024

Session Objectives

1. Describe the urgency to include training about AI in all health professions programs
2. Discuss physician competencies in AI needed for today and tomorrow
3. Define Precision Education
4. Outline opportunities to leverage AI to improve the process of health professions education

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Disclosures

Dr Howley is an Educational Psychologist,
Works FT for the AAMC,
No other relevant financial disclosures



Defining AI

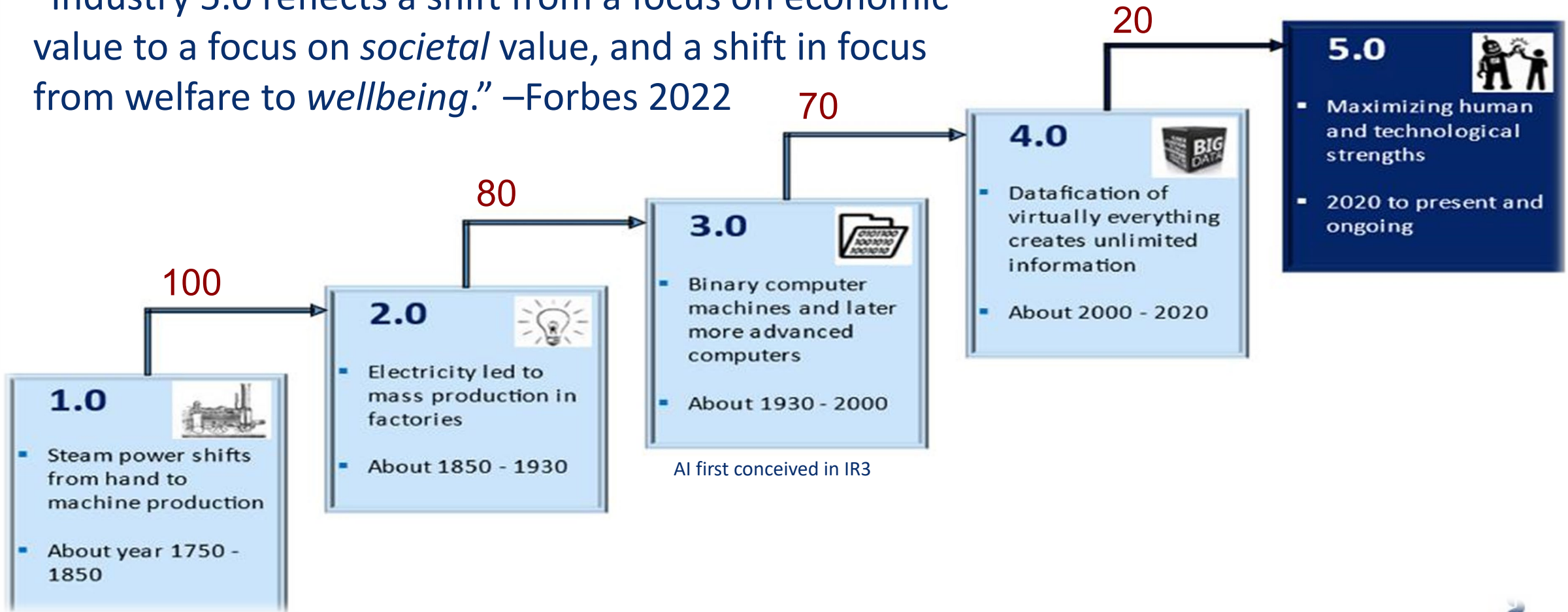
Artificial intelligence, or AI, is technology (programming) that enables computers and machines to simulate human intelligence and problem-solving capabilities.

Generative AI refers to deep-learning models that can take raw data—say, all of Wikipedia or the collected works of Rembrandt—and “learn” to generate statistically probable outputs when prompted. -IBM

ChatGPT (Chat Generative Pre-trained Transformer) is a series of chatbots developed and maintained by OpenAI. The latest versions of the chatbot are multimodal and can recognize images, generate images, engage in voice conversations. -Techopedia

Industrial Revolutions

“Industry 5.0 reflects a shift from a focus on economic value to a focus on *societal* value, and a shift in focus from welfare to *wellbeing*.” –Forbes 2022





A BRIEF STORY

By L. Howley & ChatGPT

AI in Health Care & Medical Education

AI is requiring us to reimagine **clinical practice (or Training in AI)**

- Routine information gathering, scribes and “keyboard liberation”
- Diagnostic support
- Treatment including perioperative care
- Care management
- Population health

AI is requiring us to reimagine **educational practice (or AI in Training)**

- How educators teach, collect information, assess and give feedback
- How learners seek and access information, gain new skills, self-assess, seek and regulate feedback

Are Medical Schools Including AI in Required or Elective Curricula? If so, how are they doing so?

Curriculum SCOPE Survey

The Association of American Medical Colleges (AAMC) and Association of Osteopathic Colleges of Medicine (AACOM) Curriculum SCOPE Survey, first administered in 2023, is a national questionnaire administered by the AAMC.

It collects medical education program data regarding curriculum Structure, Content, Organization, Process, and Evaluation.

Preliminary SCOPE Data...

Of 167 MD and DO granting medical schools in the United States and Canada...

- **33% (55)** reported covering artificial intelligence in the required curriculum
- **38% (63)** reported covering artificial intelligence in the elective or optional curriculum

This data is not mutually exclusive nor exhaustive.

AI will Rapidly Expand in MedEd: From Electives

*“The more I learned,
the more I realized
how vital it (AI) is to
the whole field of
medicine regardless
of your specialty.”*
—MS4



JAMA Open, 2023, 6(2), eoad037
<https://doi.org/10.1093/jamiaopen/oad037>
Research and Applications



Research and Applications

Grounded in reality: artificial intelligence in medical education

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ABSTRACT

Background: In a recent survey, medical students expressed eagerness to acquire competencies in the use of artificial intelligence (AI) in medicine. It is time that undergraduate medical education takes the lead in helping students develop these competencies. We propose a solution that integrates competency-driven AI instruction in medical school curriculum.

Methods: We applied constructivist and backwards design principles to design online learning assignments simulating the real-world work done in the healthcare industry. Our innovative approach assumed no technical background for students, yet addressed the need for training clinicians to be ready to practice in the new digital patient care environment. This modular 4-week AI course was implemented in 2019, integrating AI with evidence-based medicine, pathology, pharmacology, tele-monitoring, quality improvement, value-based care, and patient safety.

Results: This educational innovation was tested in 2 cohorts of fourth year medical students who demonstrated an improvement in knowledge with an average quiz score of 97% and in skills with an average application assignment score of 89%. Weekly reflections revealed how students learned to transition from theory to practice of AI and how these concepts might apply to their upcoming residency training programs and future medical practice.

Conclusions: We present an innovative product that achieves the objective of competency-based education of students regarding the role of AI in medicine. This course can be integrated in the preclinical years with a focus on foundational knowledge, vocabulary, and concepts, and in clinical years with a focus on application of core knowledge to real-world scenarios.

Key words: artificial intelligence, medical curriculum, intelligence augmentation, clinical analytics

Downloaded from <https://academic.oup.com/jamiaopen/article/6/2/oad037/1822631>



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● September 25, 2023

AI Meets Med School

Adding to academia's AI embrace, two institutions in the University of Texas system are jointly offering a medical degree paired with a master's in artificial intelligence.

By Lauren Coffey



UTSA. The University of Texas at San Antonio™



What AI competencies are needed of current and future physicians?

How will other competency domains be impacted by AI?

New Competencies in AI

- McCoy, L.G., Nagaraj, S., Morgado, F. *et al.* **What do medical students actually need to know about artificial intelligence?**. npj Digit. Med. 2020 **86(3)**.
- Liaw W, Kueper JK, Lin S, Bazemore A, Kakadiaris I. **Competencies for the Use of Artificial Intelligence in Primary Care**. Ann Fam Med. 2022 Nov-Dec;20(6).
- Russell RG, Lovett Novak L, Patel M, Garvey KV, Craig KJT, Jackson GP, Moore D, Miller BM. **Competencies for the Use of Artificial Intelligence-Based Tools by Health Care Professionals**. Acad Med. 2023 Mar 1;98(3):348-356.
- Jacobs SM, Lundy NN, Issenberg SB, Chandran L. **Reimagining Core Entrustable Professional Activities for Undergraduate Medical Education in the Era of Artificial Intelligence**. JMIR Med Educ. 2023 Dec 19;9



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of MEDICINE



I. Foundational Knowledge

Knowledge of AI: Explain what artificial intelligence is and describe its health care applications.

“It is more important for students to have a robust conceptual understanding of AI and the structure of clinical data science than to understand constantly changing technical specifics.” –McCoy 2020

Adapted from McCoy (2020), Liaw (2022), and Russell (2023)



II. Clinical Applications of AI

AI-Enhanced Clinical Encounters: Carry out AI-enhanced clinical encounters that integrate diverse sources of information in creating patient-centered care plans.



Adapted from McCoy (2020), Liaw (2022), and Russell (2023)

III. Collaborative AI-based Care

Workflow Analysis for AI-Based Tools: Analyze and adapt to changes in teams, roles, responsibilities, and workflows resulting from implementation of AI-based tools.



Adapted from McCoy (2020), Liaw (2022), and Russell (2023)

IV. Critical Appraisal of AI

Evaluation of AI-Based Tools:
Evaluate the quality, accuracy, safety, contextual appropriateness, and biases of AI-based tools and their underlying datasets in providing care to patients and populations.



Adapted from McCoy (2020), Liaw (2022), and Russell (2023)

V. Continuous Improvement

Practice-Based Learning and Improvement Regarding AI-Based Tools: Participate in continuing professional development and practice-based improvement activities related to use of AI tools in health care.

Maintaining safety, practicing vigilance amid deskilling (Automation Complacency*)

Adapted from McCoy (2020), Liaw (2022), and Russell (2023)

*Automation complacency = insufficient attention to and monitoring of automation output, usually because that output is viewed as reliable.



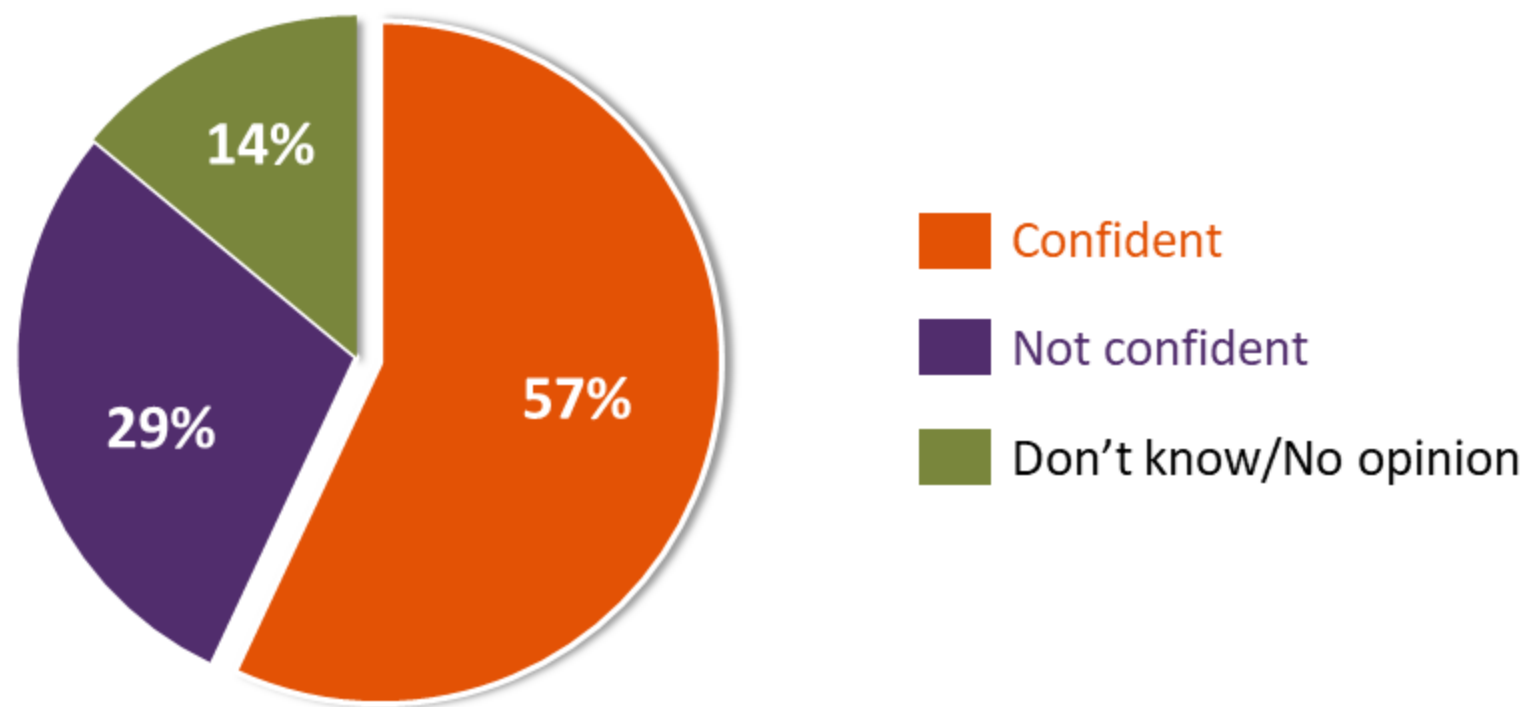
VI. Ethical Implications of AI

Societal & Ethical Implications: Explain how social, economic, and political systems influence AI-based tools and how these relationships impact ethics.



Adapted from McCoy (2020), Liaw (2022), and Russell (2023)

Most adults are confident in the ability of scientists to use AI to advance our understanding and improvement of human health.



Source: Morning Consult online poll of 2,197 adults. Data weighted to approximate a nationally representative sample based on gender, age, education, race, and region.

Other Competency Areas - Some Big Shifts...

- From disease orientation to promotion of wellness and disease prevention
- From knowledge acquisition (individual stewards of information) towards information management
- Differentiating & appreciating AI from human skills –
 - Humility
 - Metacognition
 - Compassionate care



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Disclosures

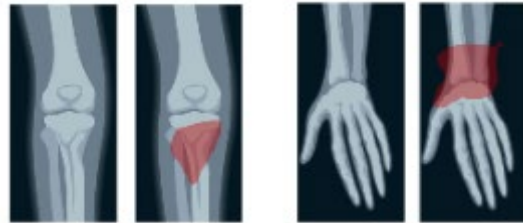
- Dr. Lomis is a full-time employee of the American Medical Association
- The content in this presentation draws upon my own work and that of other AMA staff members, as well as input from members of the *AMA ChangeMedEd® Initiative* and the *National Academy Global Forum on Innovation in Health Professions Education*
- The opinions expressed do not necessarily reflect American Medical Association policy



Use cases for AI in Health Professions Education

ChatBots (n=2)
(e.g., Q & A)

Personalized Learning Platforms (n=6)
(e.g., intelligent tutoring systems)



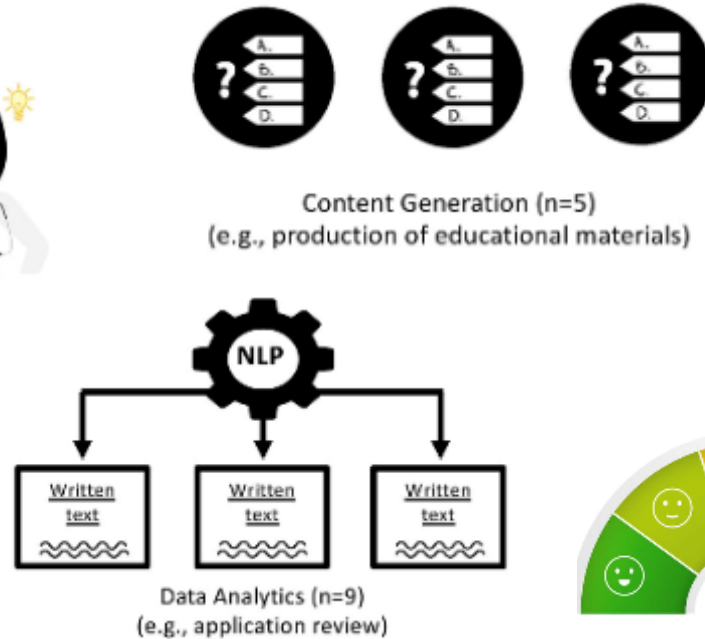
Clinical Guidance for Trainees (n=10)
(e.g., decision support tools)



Procedural Guidance for Trainees (n=5)
(e.g., directions for learning a skill)



Virtual Patient Simulators (n=11)
(e.g., clinical reasoning practice)



Performance Analytics (n=19)
(e.g., assess knowledge, skills, abilities)

Summative Assessment Completion (n=32)
(e.g., model performance on exams)

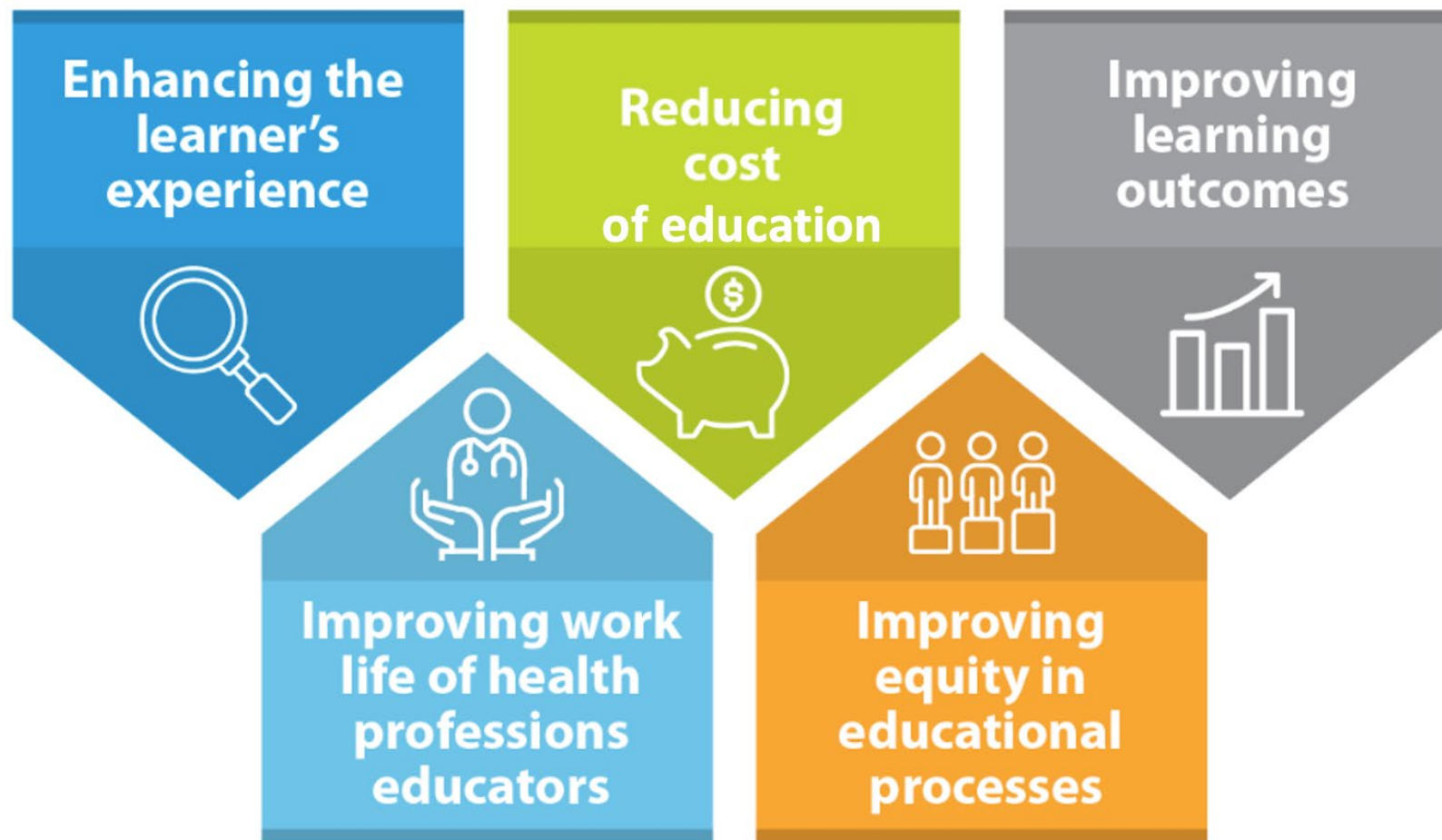
Labelling (n=2)
(e.g., telling and sorting)



Sentiment Analysis and Bias Evaluation (n=7)
(e.g., determining emotional tone from text)

Predictive Models (n=17)
(e.g., predict ability / competence)

AI is poised to drive the Med Ed Equivalent of the Quintuple Aim



<https://www.ama-assn.org/practice-management/digital/advancing-ai-medical-education-through-ethics-evidence-and-equity>

Integrating learning & work

- Just-in-time assistance & coaching
- Capturing and coding clinical experiences
- Elevating learning resources & experiences prompted by work artifacts
- More anticipatory learning
- Enabling individualized pathways



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Precision Education

A process that leverages data & technology to

- promote a true continuum of competency development throughout one's career and
- enhance alignment between learning and practice.

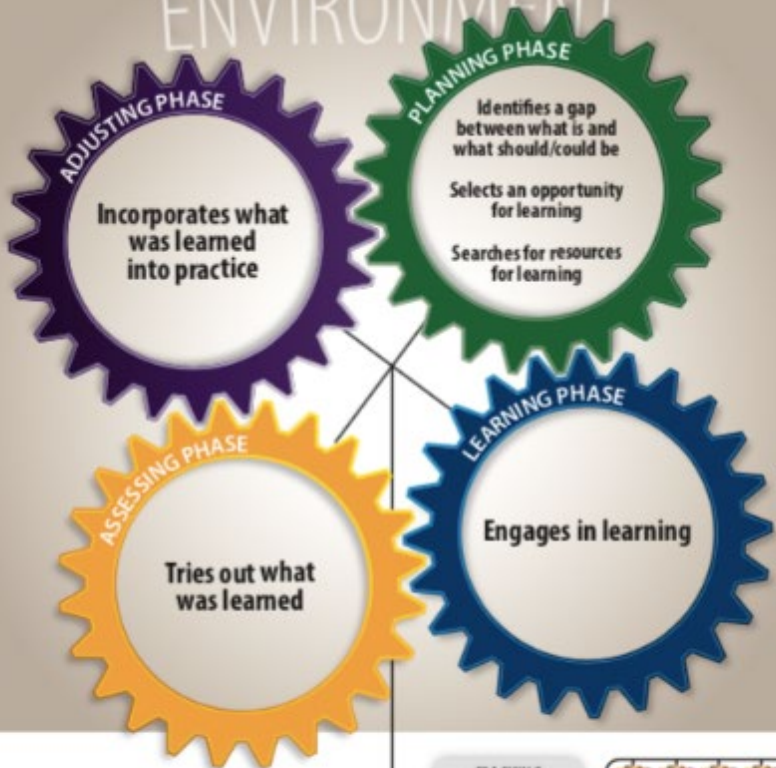




INSIDE THE MIND OF THE

Master Adaptive Learner

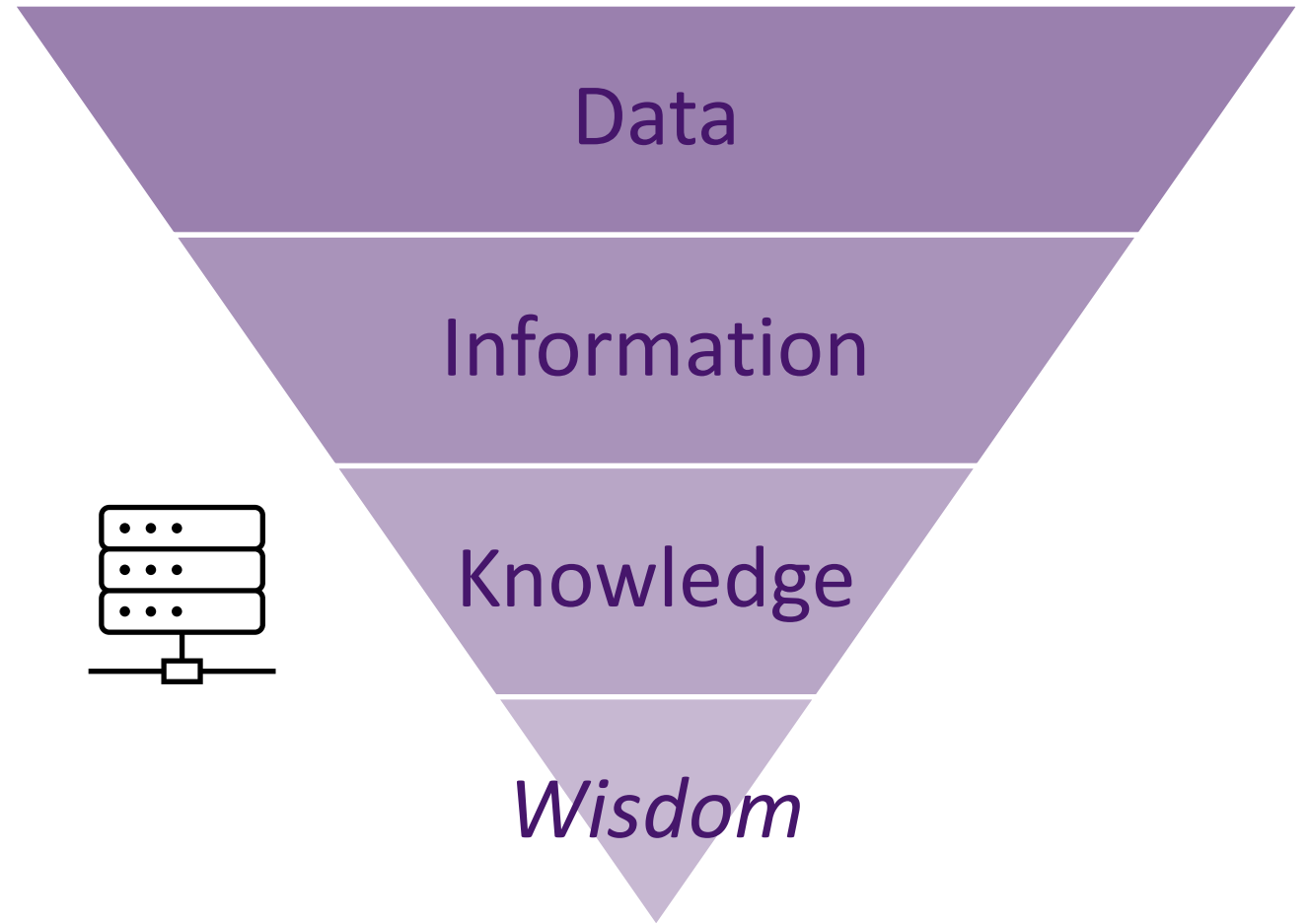
WORKING-LEARNING ENVIRONMENT



Adapted for publication in Cutrer WB, Miller S, Poonjany, Mojicano G, Mangunkalir R, Gruppen LD, Hawkins RE, Skudchak SE, Moore DE (2016). Fostering the Development of Master Adaptive Learners. Academic Medicine.

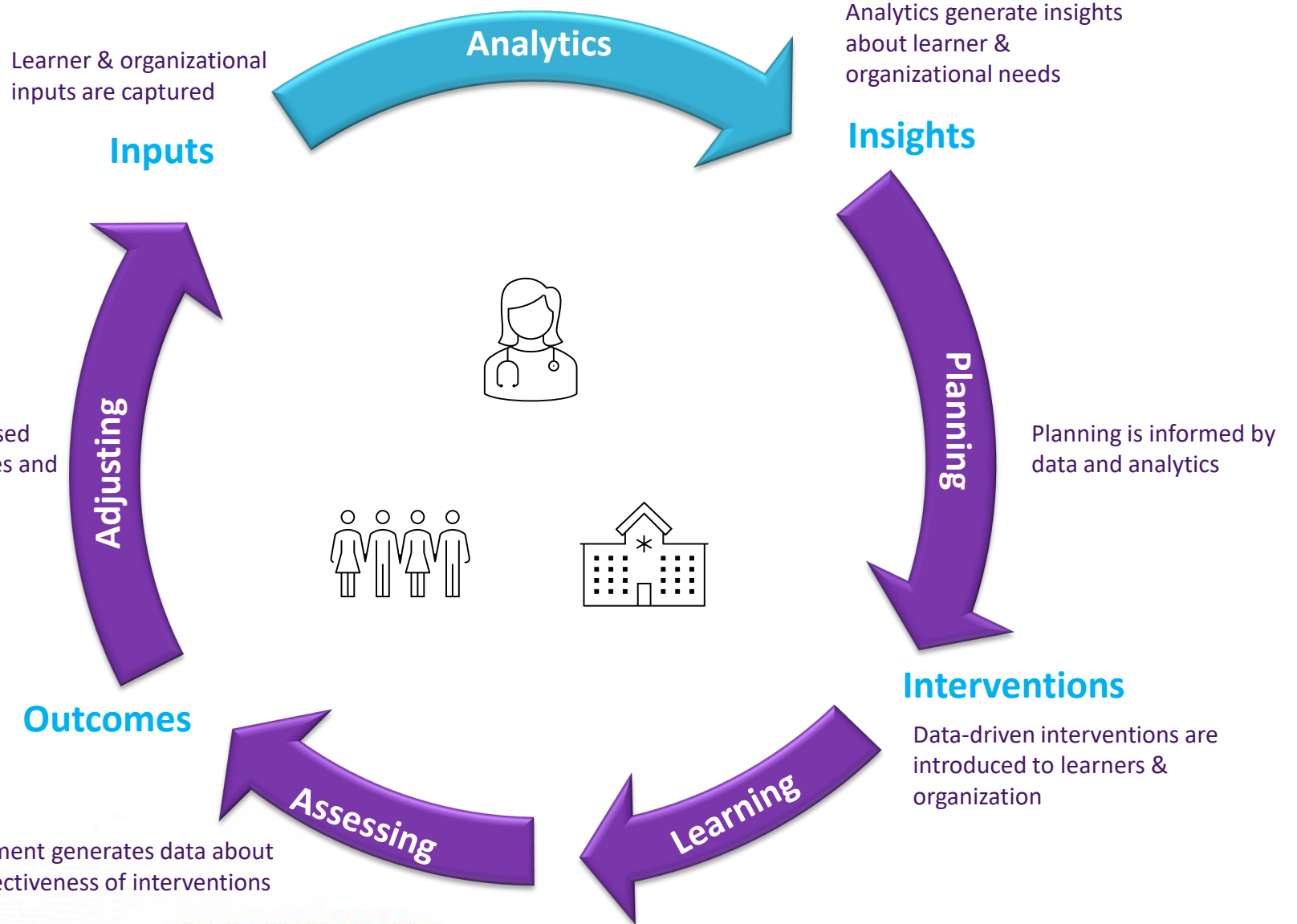
AM 2016;91:1000-1008

Cutrer et al



Precision Education System

emphasizes the contribution of data & analytics to enable –and propel– the entire learning cycle



Adjustments are made based on gaps from the outcomes and development goals

Assessment generates data about the effectiveness of interventions

Levels of engagement:

- individual (micro)
- program (meso)
- organization (macro)

Meet Jill Watson: Georgia Tech's first AI teaching assistant

Nov 10, 2016 | By Hillary Lipko



Scoring clinical notes

NLP in clinical skills assessment

A comprehensive dataset created from the USMLE Step 2 Clinical Skills patient note corpus provides an abundance of clinical patient notes, allowing researchers to explore the application of NLP models in clinical skills assessment. An important part of the dataset contains information on the myriad of ways that important clinical concepts can be expressed. Providing the content specific-data needed to build and train an NLP system opens avenues for future research and innovation in the field.

The dataset, together with expert annotation of important concepts, is available to request for research purposes via NBME's [Data Sharing Portal](#).

FOR FURTHER READING

Yaneva, V., Mee, J., Ha, L. A., Harik, P., Jodoin, M., & Mechaber, A. (2022). The USMLE® step 2 clinical skills patient note corpus. *Association for Computational Linguistics*.

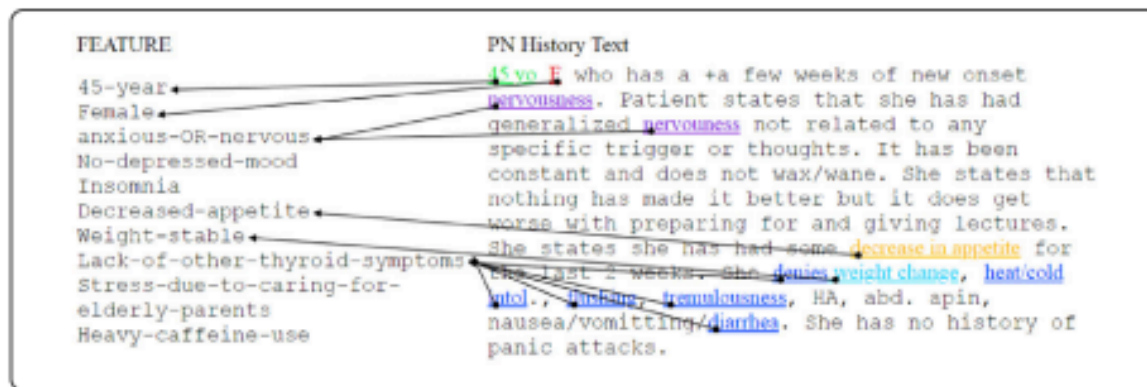
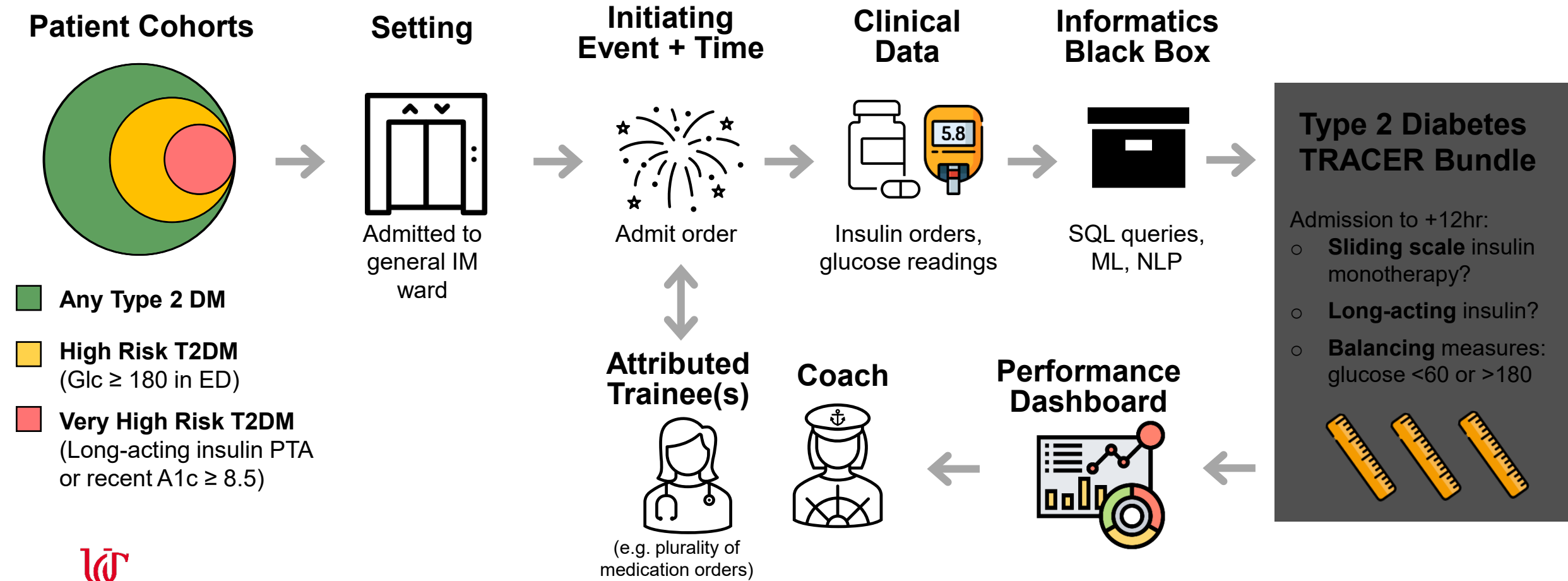


Figure 1: Key concepts from an exam rubric (left) and how these have been expressed in an examinee-written patient note (right). The more such concepts an examinee has covered in their patient note, the higher their score. NLP systems facilitate scoring by detecting these phrases automatically and mapping them to their corresponding concept from the rubric.



Providing Feedback on Clinical Outcomes: TRACER



Support from AMA ChangeMedEd

Burk-Rafel et al. TRainee Attributable & Automatable Care Evaluations in Real-time (TRACERs): A Scalable Approach for Linking Education to Patient Care. Perspectives on Medical Education. 2023.

RECONNECT



A new way to curate recent medical findings for physicians

An AI engine capable of curating educational content based on:



Upcoming patient visits



Multivariate nuances within individual patient records
[comorbidities, treatment-diagnosis combinations, medication combinations]

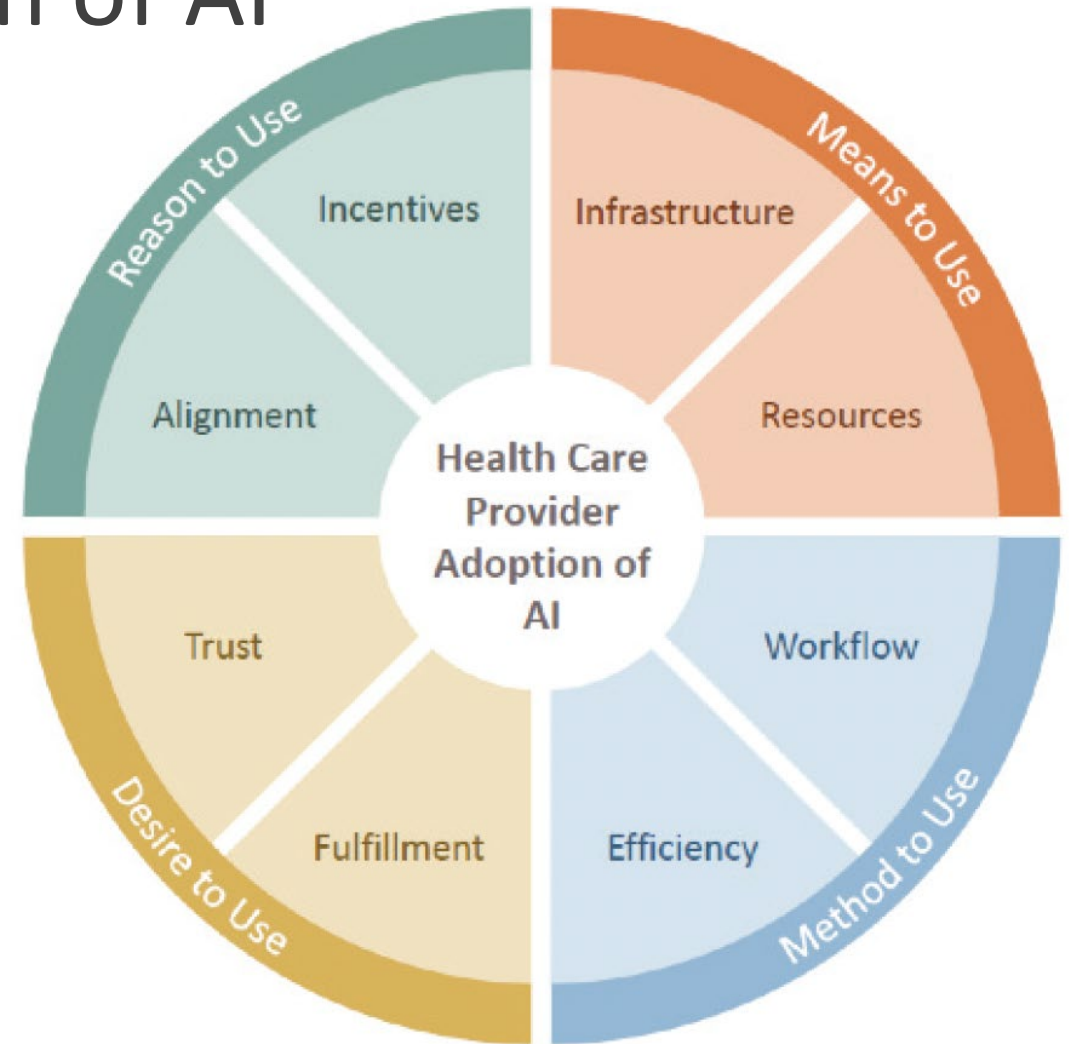


Trends within a physician's practice patterns



Challenges to implementation of AI

- Bias & disparities
- Transparency, explainability
- Dataset quality and availability
- Infrastructure, workflow
- Governance, regulation
- Monitoring & calibration drift



Current landscape of organizational activities

*a given organization may appear at multiple levels of action
 change in symbol (X, +, ^) indicates new actors joining in that level

	Guidance to constituents	Training in use of AI for HC delivery	Training in use of AI as learning aid	Training in use of AI in research	Training educators for AI use	Developing AI tools for ed use	Research about AI	AI for organizational operations	Exploring tech partners*
Direct action	XXXX XXXX (8)	XX		XXX	XXX XXX	XXX	XX	XXX XXX	XXXX XXXX
Indirect action	XX (2 repeats)	XX ++++	XX			X ++	+		
Preparation	+ (1 new)					X^^	^	+	
Contemplation								^	*11 tech companies named

TOTAL UNIQUE

9 6 2 3 6 7 4 8 8

N= 13

Priorities among leadership organizations

- Elevate urgency to provide foundational training about AI at all levels of continuum, and for medical educators
- Opportunities to advance CBME and scale innovations
 - Assessment
 - Coaching
- Consider options to support this community of innovation

Action items:

- ✓ Outreach to CHAI to collaborate in educational efforts
- ✓ Feed findings into Macy Foundation pre-work for their convening in November (with anticipated recommendations in Q1 2025)
- ✓ Suggest for discussion at Coalition for Physician Accountability meeting in December



Artificial
Intelligence
Learning Series

Developed in collaboration with



Responsible development & deployment of AI by educators



Responsibility	Innovation project team	Educational administration (deans, curric cmte.)	Educator
PLANNING AND DEVELOPMENT			
Ensure the AI system addresses a meaningful educational goal	<input type="radio"/>		<input type="radio"/>
Ensure the AI system works as intended	<input type="radio"/>		<input type="radio"/>
Explore and resolve legal implications of the AI system ¹ prior to implementation and agree upon appropriate safe, effective and equitable use of and access to education AI	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Develop a clear protocol to identify and correct for potential bias	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Ensure appropriate learner safeguards are in place for direct-to-consumer tools that lack educator oversight	<input type="radio"/>		
IMPLEMENTATION AND MONITORING			
Make educational decisions such as advancement and remediation		<input type="radio"/>	<input type="radio"/>
Have the authority and ability to override the AI system			<input type="radio"/>
Ensure meaningful oversight is in place for ongoing monitoring		<input type="radio"/>	<input type="radio"/>
Ensure the AI system continues to perform as intended through performance monitoring and maintenance	<input type="radio"/>	<input type="radio"/>	
Ensure ethical issues identified at the time of purchase and during use have been addressed ²		<input type="radio"/>	
Ensure clear protocols exist for enforcement and accountability, including a clear protocol to ensure equitable implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

<https://www.ama-assn.org/practice-management/digital/advancing-ai-medical-education-through-ethics-evidence-and-equity>

for educators...

- Educate appropriate faculty in basic concepts
- Build relationships of expertise within your institution
- Establish a local advisory group
- Review your program's competencies and curriculum
- Review your assessment program
- Review existing admissions /selection processes
- Participate in evaluation and research in AI in med ed
- Engage in global discussions to refine objectives
- Leverage AI to improve the process of education

Lomis, Whelan, et. al.

[Artificial Intelligence for Health Professions Educators](#)

National Academy of Medicine Perspectives,

September 2021



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Resources & Opportunities to Learn More



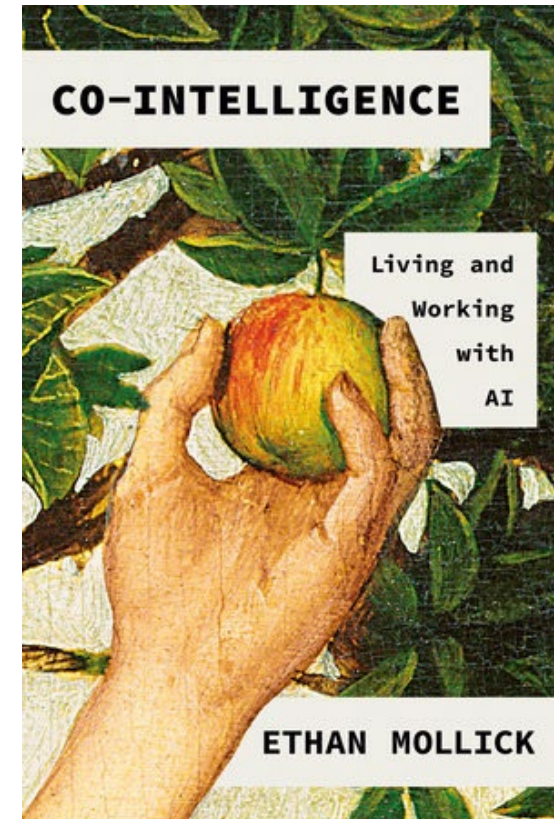
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What can you do?

- Get Experience
- Be Curious
- Get Informed
- Be Cautious
- Remember your/your institutions mission, values, principles and the goals of Health professions Education

Get Experience: Four Rules for Co-intelligence

1. Always invite AI to the table (legally and ethically)
2. Be the human in the loop
3. Treat AI like a person (but tell it what kind a person it is)
4. Assume this is the worst AI you will ever use



Mollick, Ethan. Co-Intelligence: Living and Working with Ai. Portfolio/Penguin, 2024.

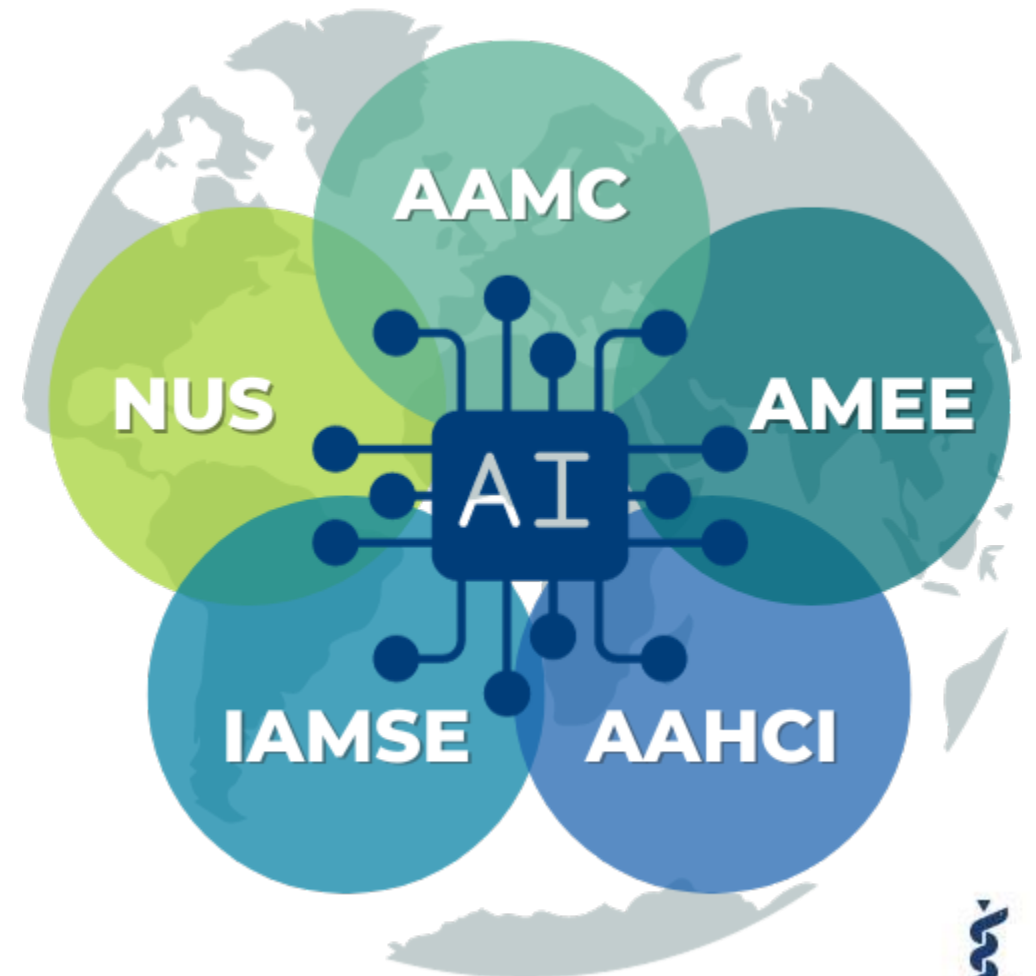
Get informed, knowledgeable READ (critically)!

- Bowen, J., & Watson, K. (2023). **Teaching with AI: How artificial intelligence is transforming education.** Routledge.
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International Advisory Committee for AI (in Medical Education)



- Inaugural 16 members representing over 10 countries with expertise in AI and medical education
- Convened to provide guidance and best practices for the HPE community
 - To *survey* the dynamic AI landscape
 - To identify opportunities and address concerns for learners, faculty, staff
 - Imagine new realities for medical education in this AI era



Artificial Intelligence

Learn from Experts, Share Your Innovations & Engage with Colleagues



- Webinar series
- Key resources collection
- Discussion threads
- Virtual community
- And More

Stay in touch:
curricularinnovation@aamc.org
lhowley@aamc.org

The screenshot shows the AAMC Communities website. The header includes the AAMC logo, the word "Communities", and navigation links: Home, Member Spotlight, Resource Bundles, Communities, Help, Directory, and Participate. There is also a search icon, a user profile icon, and a "Create" button. The main content area is titled "Artificial Intelligence and Medical Education". Below the title is a large image of a brain composed of glowing circuitry. To the right of the image is a text block that reads: "The landscape of artificial intelligence (AI) is quickly evolving. In medical education, advances in this technology have led to new opportunities for educators, learners, and staff as well as questions and challenges around best practices and ethical use. This collection includes scholarly resources, in-person and virtual events, and other information to help you stay up to date on the latest work happening across medical education. Also included are opportunities for you to engage with colleagues and experts in AI, large language models, machine learning, and more. If you're viewing this page as a non-member of the AAMC Communities, consider registering and joining the conversation!" Below the text is a "Register Today" button with a right-pointing arrow.



Principles for Responsible AI in Medical School Admissions and Residency Selection

- 1) Balance Prediction and Understanding
- 2) Protect against Algorithmic Bias
- 3) Provide Notice and Explanation
- 4) Protect Data Privacy
- 5) Incorporate Human Judgment
- 6) Monitor and Evaluate



COMING SOON! Principles for Responsible AI in Medical Education

Now Open! AI in Health Professions Education Virtual Community

Join this virtual forum to share ideas, ask questions,
learn from experts, connect with peers, and grow
professionally.



Call for Submissions: Artificial Intelligence Education

MedEdPORTAL invites submissions of responsible and ethical implementation AI tools in teaching, learning, and assessment towards the aim of improved patient care

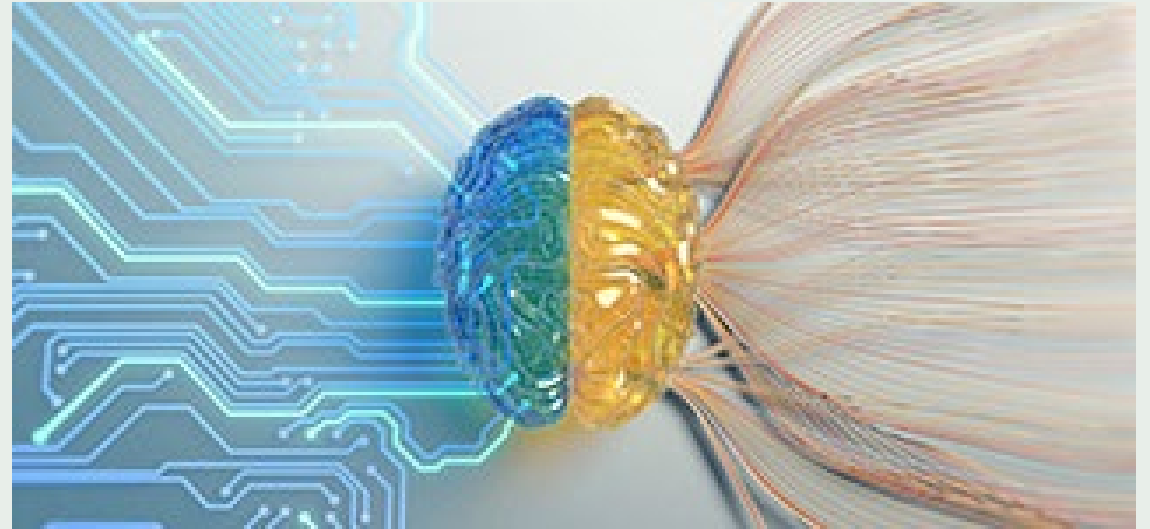
Collection Editors



Cornelius James, MD
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Elissa Hall, EdD
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training in AI

AI in training



Introduction to Artificial Intelligence in Health Care



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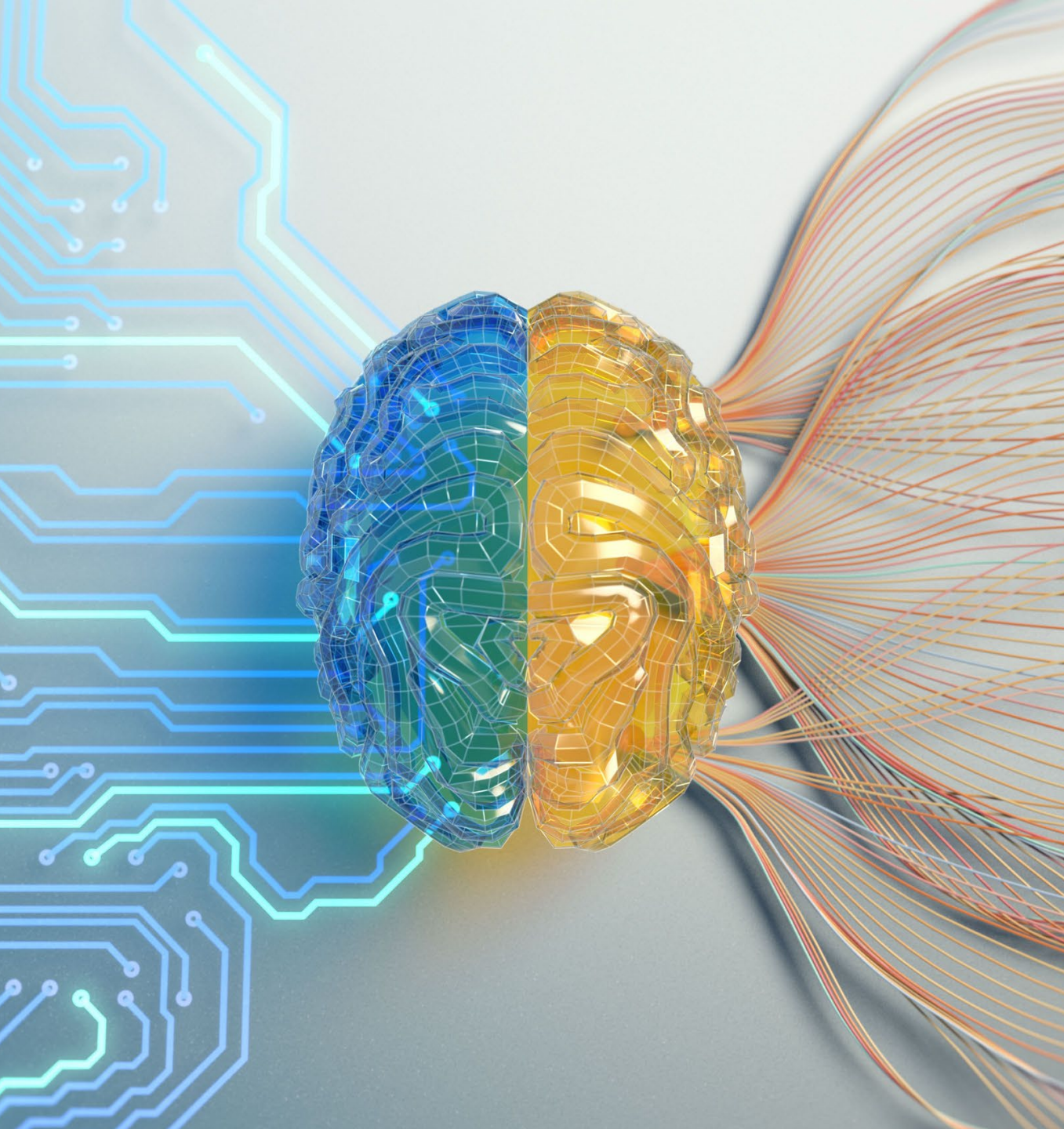
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ARTIFICIAL INTELLIGENCE IN HEALTH CARE SERIES

<https://edhub.ama-assn.org/change-med-ed/interactive/18827029>

Questions?

Thank you!



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Education**

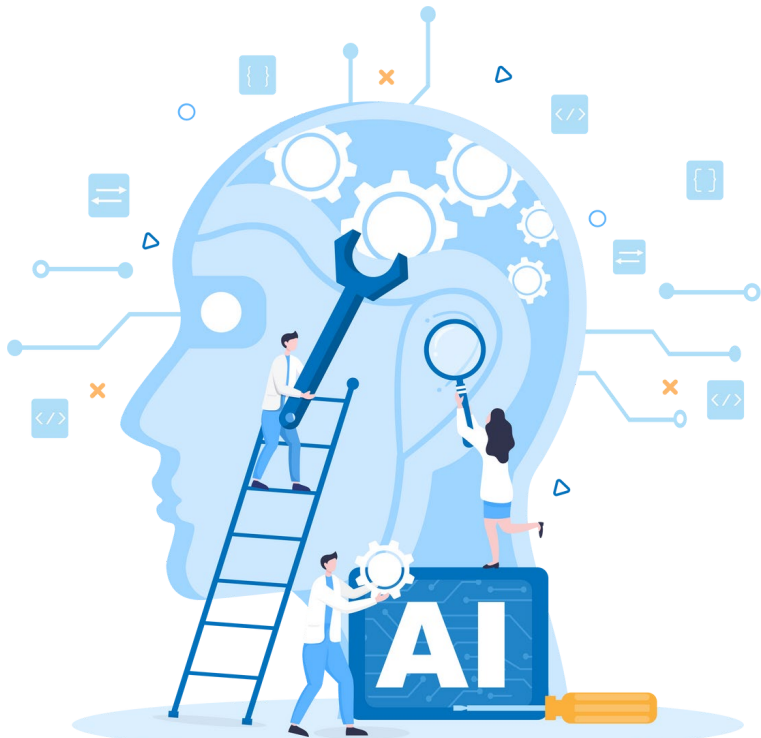
**LEARN
MORE**



CALL FOR SUBMISSIONS Advancing AI Across Academic Medicine Resource Collection

This call for submissions of early educational materials, promising practices, policies, and pilot projects is now open.

Selected submissions will be included in a collection launching spring 2025.



The goal is to advance collaboration and knowledge sharing and spark innovative thinking.

**SUBMIT BY
FEBRUARY 14!**



2025

Emerging Technologies for Teaching and Learning Digital Demonstrations Virtual Conference



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educational technology
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learning in HPE.

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- Accreditation
- Application of AI tools
- Clinical skills assessment
- Competencies
- Content delivery
- Content development
- Curriculum mapping
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- Simulation
- Student Support Services

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Upcoming AAMC AI Webinars

Stay tuned for more information on our 2025 AI webinar series!

Past AAMC AI Webinars

*Building AI Partnerships Across Medicine, Industry & Government –
Sept. 24, 2024*

*The Use of Artificial Intelligence (AI) Tools in the Scholarly Publishing
Process: Considerations and Practical Suggestions for Scholars –
Sept. 10, 2024*

- *Video recording*
- *Presentation slides*
- *Q&A section summary*



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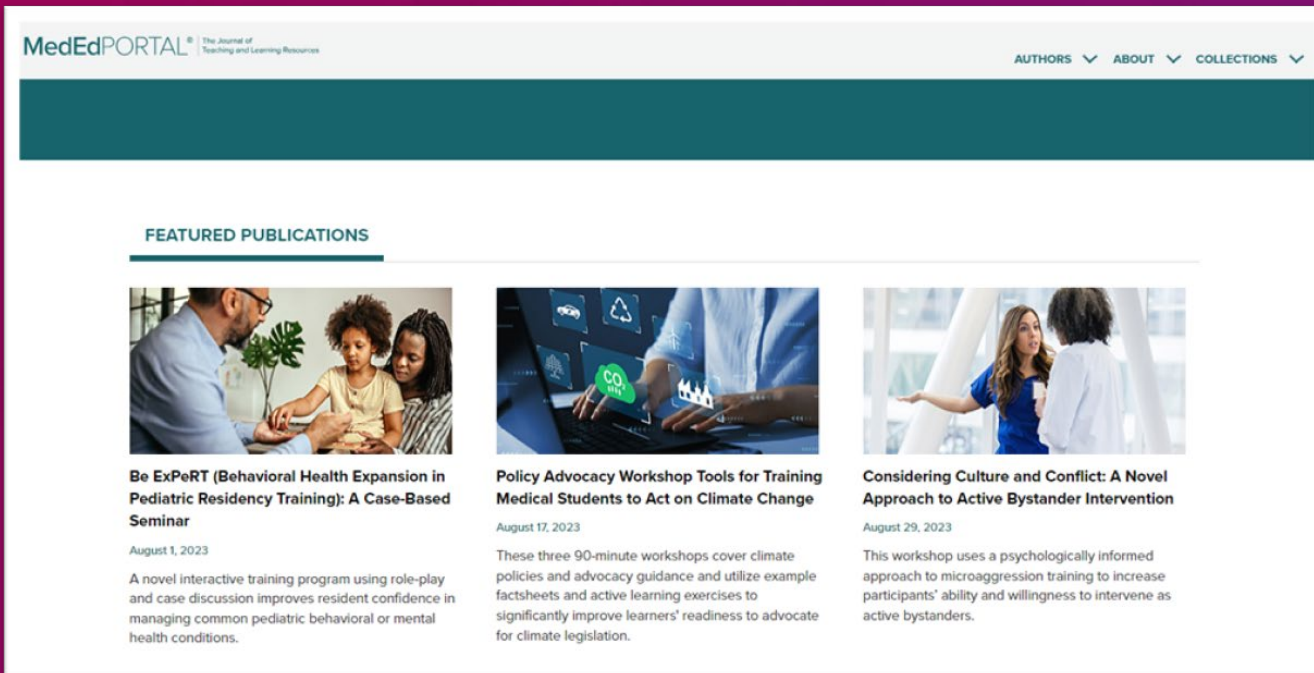
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The screenshot shows the MedEdPORTAL website homepage. At the top left is the logo "MedEdPORTAL® The Journal of Teaching and Learning Resources". To the right are navigation links: "AUTHORS", "ABOUT", and "COLLECTIONS". Below the navigation is a dark teal horizontal bar. Underneath is a section titled "FEATURED PUBLICATIONS" with three articles:

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A novel interactive training program using role-play and case discussion improves resident confidence in managing common pediatric behavioral or mental health conditions.
- Policy Advocacy Workshop Tools for Training Medical Students to Act on Climate Change**
August 17, 2023
These three 90-minute workshops cover climate policies and advocacy guidance and utilize example factsheets and active learning exercises to significantly improve learners' readiness to advocate for climate legislation.
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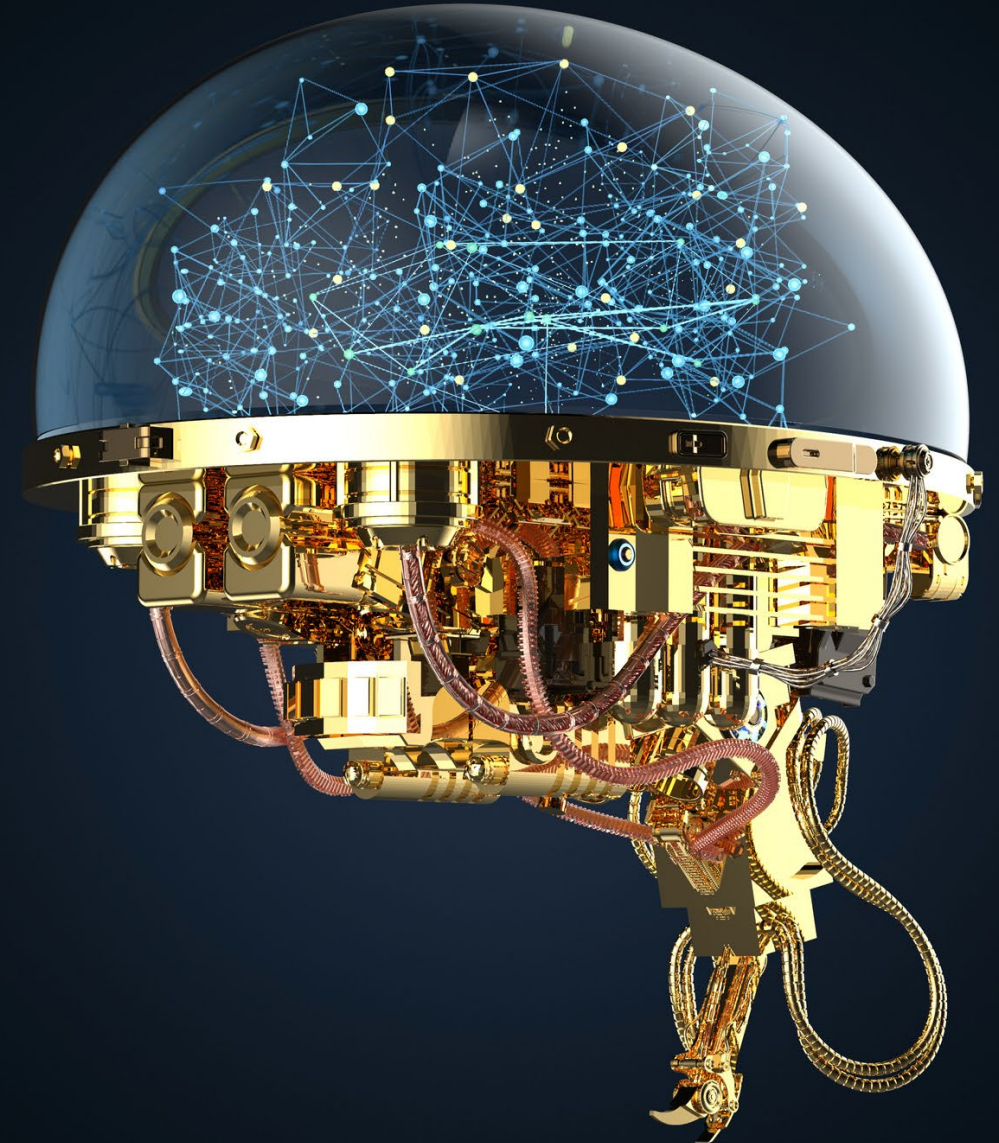
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